THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIX. No. 1771.] LONDON, APRIL 20, 1897. [49TH YEAR. PRICE 6d.

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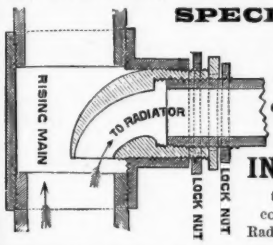

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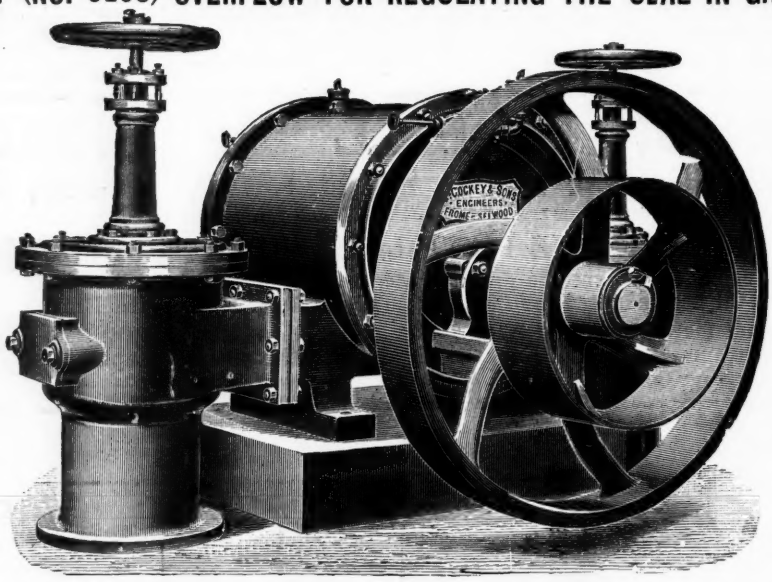

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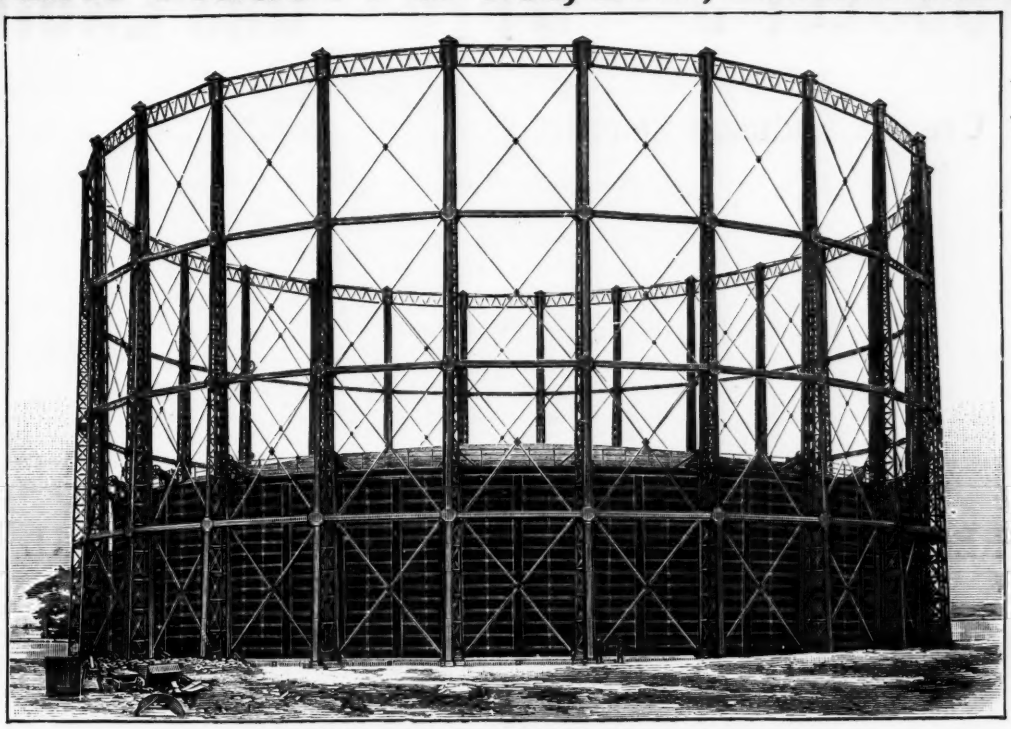

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Fig. 705. "SINGLE RAM" STEAM-PUMP.

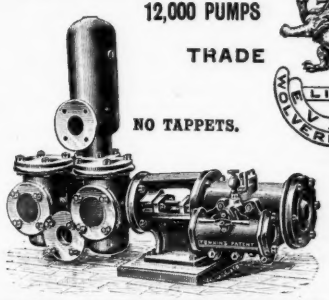

Fig. [598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

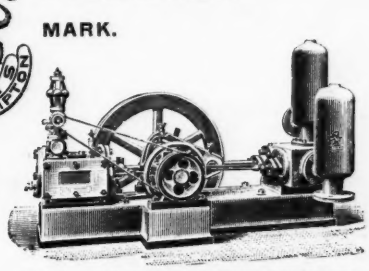

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

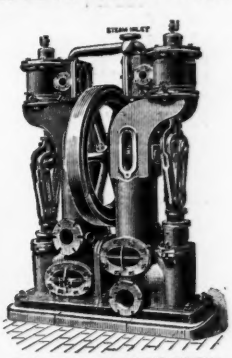

Fig. 712. "DOUBLE-RAM" STEAM-PUMP

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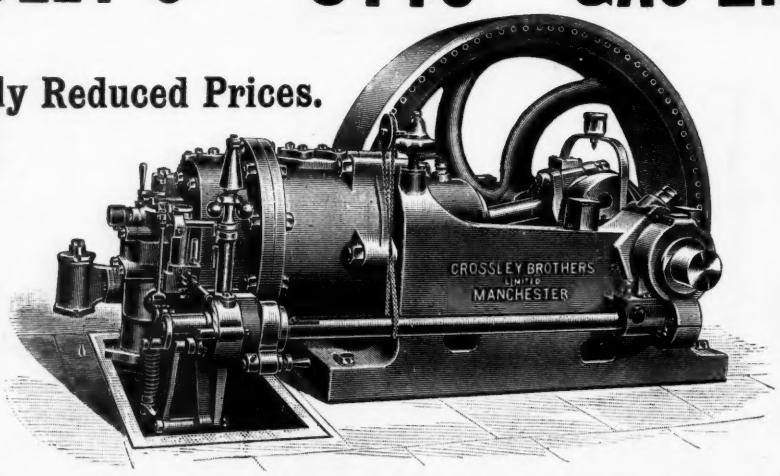

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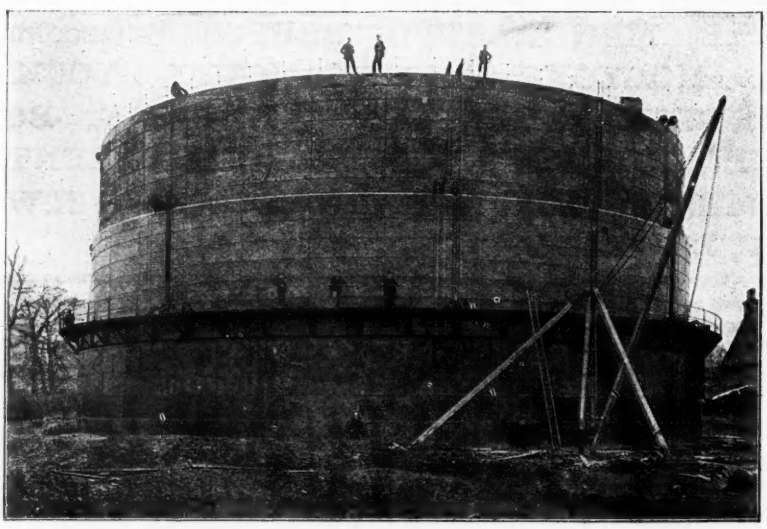

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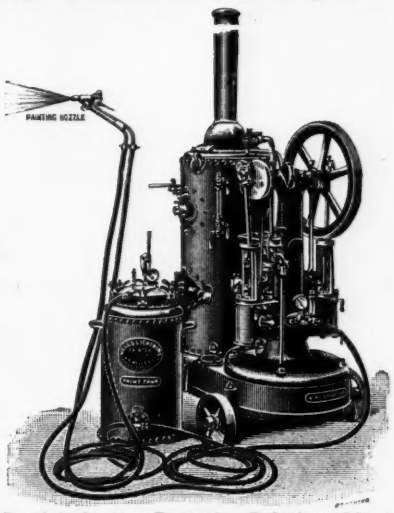

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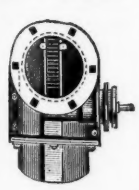

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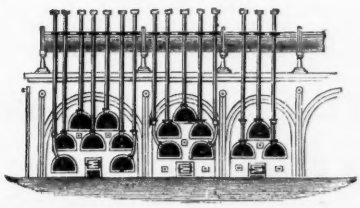

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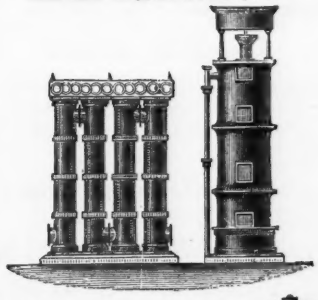

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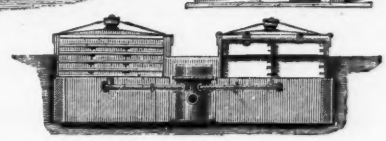

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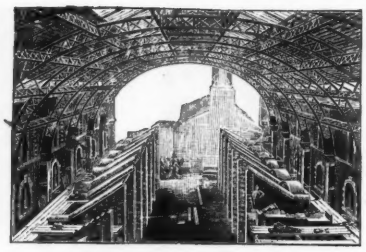

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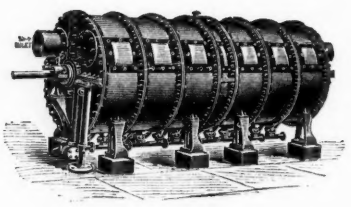

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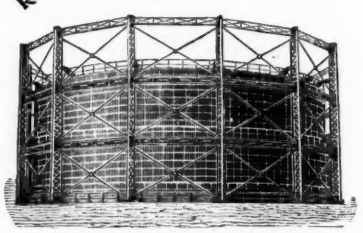

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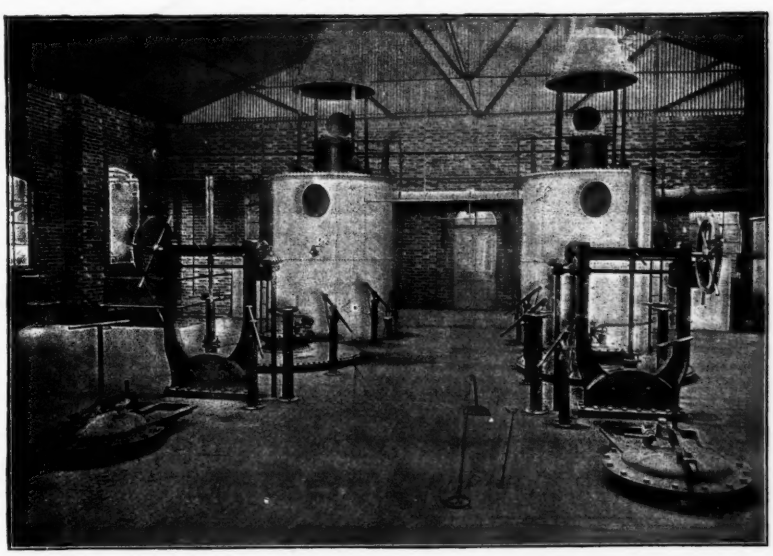

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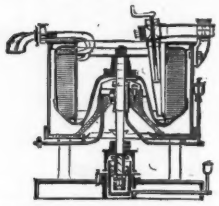

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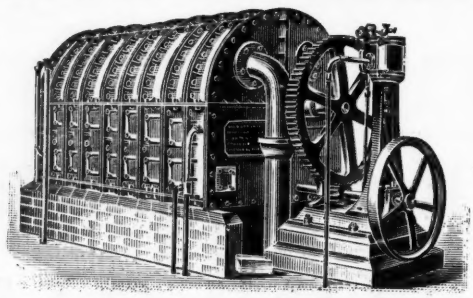

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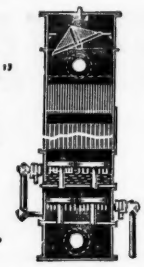

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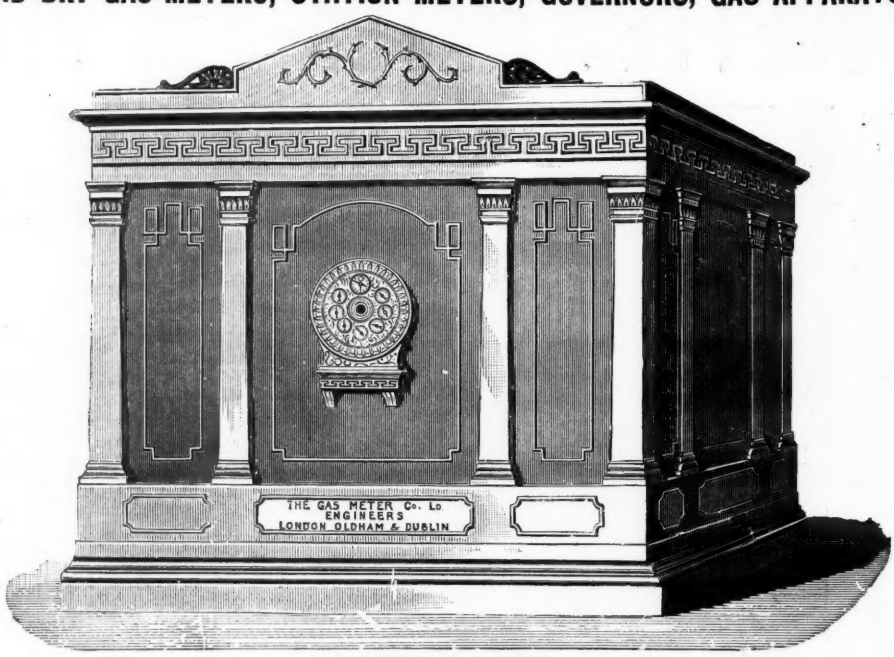

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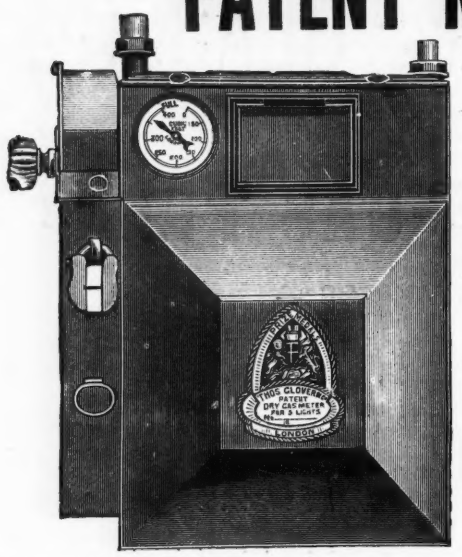

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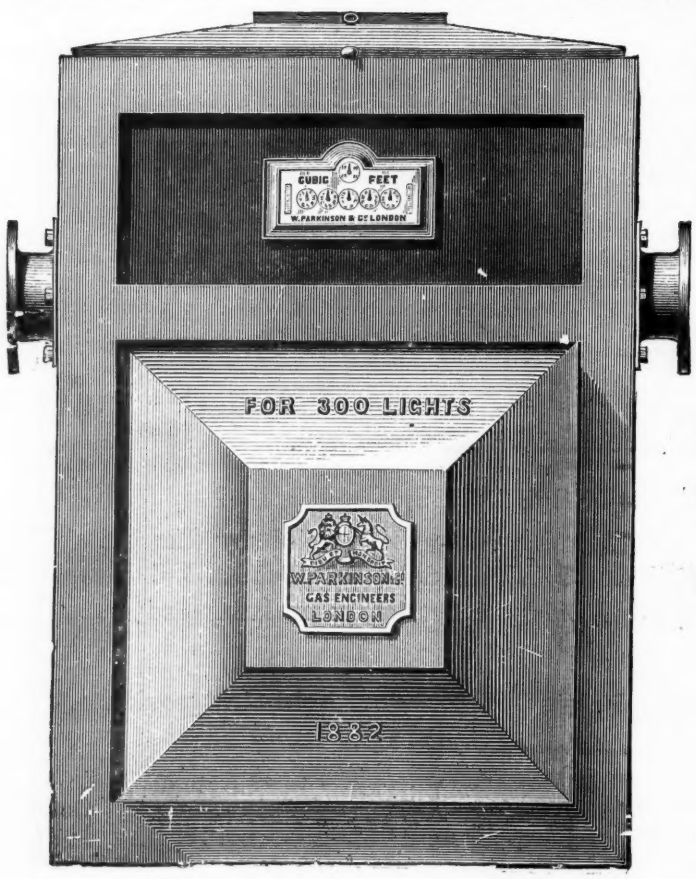

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[See also Advt., p. 912.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

EDITORIAL NOTES.

Report of the Massachusetts Board of Gas Commissioners.

THE annual report of the Board of Gas and Electric Light Commissioners of Massachusetts has been sent to us, as usual, through the kindness of Mr. F. E. Barker; and in another column will be found the principal statistics contained in this interesting and valuable public document. Before proceeding to deal with the matter of the report, we must pause to congratulate the Board on the promptitude with which they have issued it. In this country, we are accustomed to the widest differences between official and private interpretations of the length of time that should be permitted to elapse between events and their chronicling in whatever publications may be devoted to this purpose. We like our news served up fresh once or twice a day, except Sundays; and works of reference published annually by private enterprise are not considered trustworthy unless they take account of matters that happened a fortnight or so before one receives the volume. When it is a case of a Government publication, however, it is accepted as fairly up-to-date if it comes out the year but one after the period to which it is made up. Government is not singular in this dilatoriness, for many of our technical societies are as leisurely in preparing their records. The Board of Gas and Electric Light Commissioners of Massachusetts are exemplary in this regard; and for this they deserve warm commendation. Not, of course, that promptitude in the issuing of their annual reports is the most conspicuous of the Board's merits. They appear to supply a shining exception to what is commonly understood to be the character of public authorities in only too many parts of the United States, inasmuch as, having been appointed for the purpose of performing certain duties, they do them in the spirit of their charter. At the present time, the operations of the Board are instructive for those who are curious to know how the public regulation of gas and electricity supply undertakings is managed in different parts of the world. They have under their supervision 133 companies, 12 towns, and 1 city; and the various lighting businesses carried on by these various Companies and Corporations are characterized by a pleasing degree of irregularity. Some do only private lighting within a select area; others do anything that comes in their way. Some have experience of the ways of receivers; and all are exposed to vicissitudes unheard of in other climes. The Board were asked during the year to extend their good offices to suppliers and consumers in a variety of circumstances, and appear to have given satisfaction in the majority of instances.

There is nothing particularly new in the mediatory or judicial work of the Board for the past year; but they have now been in existence for a sufficient period to have accumulated set precedents to guide them in dealing with petitioners, and it may not be out of place to mention their manner of disposing (say) of a popular petition against a gas company alleging an excessive rate of charge for gas. A good example is furnished by the Jamaica Plain petition. The district supplied by the Company of this name is a single ward in Boston City, mostly residential, but considerably cut up for parks and other public reservations. The Company have made reductions in price from time to time, and have kept their works abreast of the requirements of the district. There was nothing wrong with the capital account. The principle adopted by the Board in former cases, "that a company under skilful management "is entitled to charge such a price as will provide for the "fair cost of manufacture and distribution, and a reasonable amount beyond this for depreciation in plant and "a proper dividend," was freely accepted as sound by the petitioners. The Company were placed at a disadvantage by the circumstance that their neighbours, doing a bigger trade, and possessed of better paying districts, were selling gas at a considerably cheaper rate. This fact naturally bulked largely in the case against the Company; and it was not diminished in importance by the discovery that the Company had been in the habit of putting away larger profits since their neighbours began to throw them into the shade than they had previously distributed. "In support "of this course, it was urged that the investment had "become an especially hazardous one, and that the right "of larger and stronger companies to enter the territory "and destroy the value of the stock justified the payment "of large dividends while the opportunity existed." The

Company, in short, thought they had better make as much hay as they could while the sun shone upon them. To this policy the Board opposed the suggestion that, if the Company wished to preserve their corporate integrity and privileges, it would be better for them to cut their price as nearly as possible to the level of the surrounding undertakings, even at the sacrifice of a portion of the former profit. For this reason, they recommended the Company to reduce their price to $1·40 per 1000 cubic feet.

An interesting section of these annual reports is always the one referring to "Accidents." During the past year, the attention of the Board was called to 76 different instances of escaping gas, which resulted in the death of 51 persons and injury to 118 others. "This is a large "increase over the previous year. . . . The Board "feel it their duty to call public attention to this increase "in the number of accidents from illuminating gas. Many "are undoubtedly cases of suicide; and, while others "may point that way, a close examination tends to "show that some of them were more likely due to "imperfect fixtures." No attempt in any case is made to show the composition of the gas which did the mischief; but some of the details are sufficiently alarming. A broken main in a Boston street filled a whole block of buildings with gas, which killed one child and partially asphyxiated nearly a hundred persons of all ages. The instances of people found dead in bed with a single unlit gas-burner left wholly or partly open, are startlingly numerous. Generally, the first intimation given of the state of affairs was the strong smell of gas emanating from the room, which goes to show that the odour does not alarm the victim. One man is catalogued as having "come home late" at night, yet when his room was broken into at six o'clock the next morning he was dead. "It seemed probable that in turn-"ing off the gas he made a mistake and turned it on again." Suicide has been made easy in Boston, to judge from these reports, which are painful reading. Boston cases, both of death and of partial asphyxiation, are by far the most numerous. Indeed, out of all the deaths due to inhalation of gas, only a dozen occurred elsewhere. There were several deaths in Lowell, and others at Dorchester and Roxbury. These are extremely grave facts. It is a curious thing that, in their classification of illuminating gases, the Board apply the term "coal gas" to all gas except that made entirely from oil distilled in closed retorts. Carburetted water gas has therefore vanished from the lists, which makes confusion; and it is only to be discovered in a special table giving the processes employed in 23 cities and towns. These matters need further investigation.

The Course of the Petroleum Inquiry.

The petroleum inquiry is dragging its slow length along, it is to be hoped towards a definite and conclusive report. It would not be fair to complain, as there is a disposition to do in some quarters, of the great detail to which the Committee are pushing their inquiries, or of the patience with which they are hearing anybody and everybody who can give any positive information concerning the trade in, and the popular use of, lamps and lighting oil. It is eminently desirable that the whole matter should be thoroughly threshed out now, for there will hardly be another parliamentary inquiry into the subject for a generation. So far, the weight of evidence appears to have gone against the idea that the trade should be subjected to further legislative restrictions in the interest of public security. Many witnesses think that lamps are often of too slight construction; but there is a strong agreement that the majority of lamp accidents are traceable to carelessness and improper handling, which no legislation would be competent to prevent. It has been stated that the volume of the trade in the so-called low flash-point American oil is enormously in excess of that in high-flash or in Scotch paraffin oil. This, of course, was known before. It was also shown that the high flash-point oil is also invariably of higher price than the bulk of the lighting oil sold; and the conclusion was drawn that the one factor controlled the other. The introduction of tank steamers and tank storage for oil was also stated to have rendered the traffic much safer than was the case in the days of barrelled oil. Mr. Dowling, of the firm of Messrs. Pinchin, Johnson, and Co., was a typical witness of the "let-it-alone" contingent. He told the Committee that, in his judgment, the conditions under which the trade is now carried on leave little to be desired. He went on to declare that petroleum, especially American, possesses the advantages over Scotch paraffin oil of better appearance in the lamp, that it has a less disagreeable odour and a flame of better colour, and, "above all, that it burns "more readily, and gives a superior light with little or "no attention." He claimed to speak with some authority upon the importance to the poorer section of the working population of the free and competitive sale of petroleum. The witness said "petroleum is essentially the light of "the poor family; in many of the lower neighbourhoods "an imperial pint of petroleum is sold for ¾d. This "quantity is sufficient to supply the ordinary poor man's "lamp, carrying a ¾-inch wick, for fifteen hours, or, on the "average, three evenings' light. In fact, the part which "the pint of oil plays in the very poor man's household "is perhaps only second in importance to that of his "quartern loaf." This, we may take it, is the strongest case that can be made out in favour of cheap lamp oil; and it indicates the force of the competition that the prepayment gas-meter has to meet. Mr. Dowling, moreover, did not forget the interest of the gas industry in cheap petroleum. He reminded the Committee that "Gas Com-"panies are using the article in increasing quantities." These are grave considerations to set against the hypothetical assertions that to raise the flash-point of burning oil to (say) 100° would not seriously increase its retail price, and would operate powerfully in decreasing the risk of lamp accidents.

The Crisis in the Engineering Trade.

During nearly the whole of last week, the representatives of employers and employed in the engineering trade were conferring in London upon the various points of difference that have arisen of late in the trade. It was reported in the newspapers that fair progress was being made with the composure of these differences, with one conspicuous exception—the question of labour in connection with machines. It appeared at the beginning of the holidays that this matter would, after all, be left open. If this is so, then it must be concluded that the conference has failed of its main purpose, which was to restore peace to the engineering industry of the country. Sooner or later, the question of the right of employers to manage their business in their own way, whether in regard to the use of labour-saving machines or otherwise, will have to be settled. If this settlement can be attained by peaceful means, so much the better; but it will have to be achieved somehow, as the condition of continuance of the national industry. Nowadays the key-note of Trade Unionism seems to be not merely that work exists for the sake of the workers, but also that their own judgment for the time being as to the manner in which this relation should be expressed is to override every other opinion in regard to the matter. English engine-fittters appear to ignore the consideration that men of other nations can fit machines together as well as they, and that there is no reason in the nature of things why the head-quarters of the mechanical engineering trade should remain in this country. At the present moment, the iron and steel trade of the United States is pushing the home trade very hard; and iron and steel are the raw materials of mechanical engineering. It is stated that during the past year, for the first time, American pig iron was put upon the British market in such quantities as to affect prices; and this is expected to be only the beginning of a regular invasion of which no man can foretell the issue. The British iron manufacturer has long been nurtured very largely upon imported ores; but if the importations are to take the form of the finished or half-finished metal, the trade will experience a great change, which will not necessarily redound to the advantage of the British workman. Decidedly, the present is not a favourable time for pushing the doctrine of the "Union stroke" to any great lengths. Rather might it be said that the Trade Union ideas in this regard need reconstruction upon a principle that has always been recognized in economics, so that he shall be esteemed the best workman who will most reliably assist his shop to turn out two tons of finished product where only one ton was made before.

In re Henry Heath, C.B.U.

The vain practice of stringing a number of initial letters after one's name has often been ridiculed, and in certain connections specifically discountenanced and condemned. It is well known, for example, that the use

of the valueless letters "C.E." after the signature of a person claiming to profess civil engineering as a regular calling, is discouraged by the Institution of Civil Engineers. In this instance there was unquestionably at one time the sanction of custom for the practice, which originated in the early days when civil as distinct from military engineering was struggling to gain a status as a regular profession. This stage of the development of engineering has long been passed through, and with it has disappeared the need, such as it was, for the assumption by engineers of a self-bestowed "handle" to their name. Nowadays the habitual use of the letters does not confer upon those who still cling to them the kind of distinction they would like to enjoy. We dealt with this topic in these columns some time ago *à propos* of an amusing newspaper discussion of the subject. Though plenty of ridicule was then poured upon the vanity that induces certain men to string after their names various combinations of capital letters devoid of all really honourable significance, it had perforce to be admitted that there are people who are impressed by these additions to an otherwise undistinguished cognomen. Hence it was agreed that so long as there was any advantage, however shadowy, to be gained by this method of self-advertisement, men would be found to practise it. Something has recently transpired, however, which ought to do more to check this nonsense than any amount of argument or ridicule. We reported in our "Legal Intelligence" last week the conviction and condemnation to a term of imprisonment of an individual who had for a long time been engaged in defrauding tradespeople by obtaining goods of many kinds, including gas stoves and fittings, without paying for them. His career was stopped at last by a Government prosecution, under the Bankruptcy Acts, for obtaining goods by credit without revealing the fact that he was an undischarged bankrupt. His defence to this charge was that he had been in the habit of using after his name the letters "C.B.U.," which signified "Court of Bankruptcy "Undischarged," and was meant to be a sufficient notice of the fact. This sounds very like an extract from a comic opera; but it was in sober truth the substance of the defence raised by William Hellier, *alias* Henry Heath, erstwhile of Heath House, Lydd, now of Her Majesty's Prisons. After this, the trick of adding mysterious or meaningless letters after signatures should go definitely out of fashion.

North of England Gas Managers' Association.—As already intimated, the half-yearly general meeting of the Association will be held in Newcastle-upon-Tyne on Saturday next, under the presidency of Mr. J. H. Penney, of South Shields. The only paper will be the one by Mr. Sisson, previously mentioned, on "Testing Apparatus for Small Gas-Works."

Incandescent Gas-Light Companies in Germany.—The advertisement columns of the "Zeitschrift für Beleuchtungswesen" of the 10th inst. contain an announcement by the Meteor Continental Incandescent Gas-Light Company which has a far deeper significance than is apparent at first glance. The Meteor Company state that they are not confident of the ultimate issue of the lawsuit which for a year past has been waged between them and the German Incandescent Gas-Light (Welsbach) Company. In order to avoid further risk and the enormous costs of this lawsuit, the Company have come to an agreement with the Welsbach Company by virtue of which they will henceforth cease to make and sell mantles and burners for the incandescent gas-light, and confine themselves to the manufacture and sale of incandescent petroleum lamps. To avoid all risk of litigation, they will obtain the mantles for these lamps exclusively from the Welsbach Company. The true bearing of this agreement with the Welsbach Company is shown by Dr. H. Lux in the same issue of our contemporary. The Meteor Company have been the most determined and prominent opponents of the Welsbach Company, and the energies of the latter were specially directed against them. The ultimate issue of the litigation on the rights of the Welsbach Company in Germany is not affected by the secession of the Meteor Company from the ranks of the opposing firms; but the latter have now lost the help of the Company who so far have borne the lion's share of the cost and trouble of the litigation. To the determined front shown by the Meteor Company the German public primarily owe the cheapening of the incandescent gas-light in that country. Dr. Lux is much grieved to find that the material interests of the shareholders of the Meteor Company have compelled the Company to renounce their former position of antagonism to the Welsbach monopoly, and to desert their whilom colleagues in the struggle. He considers that the comparatively untouched branch of incandescent lighting to which the Meteor Company will now devote themselves is likely to prove a source of considerable profit to the undertaking.

WATER AND SANITARY AFFAIRS.

Lord Llandaff, who (as Mr. Henry Matthews) held the office of Home Secretary under the Administration of Lord Salisbury in 1886-92, is stated to have been offered and to have accepted the chairmanship of the Royal Commission on the Metropolitan Water Supply. Mr. Shaw-Lefevre, who was President of the Local Government Board in connection with the Ministry of Lord Rosebery, has described the appointment of the Royal Commission as something which he "thoroughly distrusted." It now becomes clear that all the outcry raised by the Progressive party concerning the water supply is simply an electioneering device to gather votes for the contest which comes on in March next. The tactics employed in the parliamentary election for Whitechapel are to be repeated on behalf of the County Council; and the plan is to be pursued again as described by "The Times" the other day: "Get votes—honestly if you can—but get votes." We now understand how it is that the most outrageous statements are reiterated, notwithstanding their complete refutation; and preposterous assertions are paraded forth with unblushing confidence in the face of absolute disproof. The audacity displayed is almost heroic. Mr. Shaw-Lefevre has sounded the war-note at the East-end; declaring at a public meeting that the action of the Government in regard to the Metropolitan Water Companies was "scandalous," and giving his support to a resolution indignantly condemning the conduct of the Ministry in rejecting the Council's Water Bills. Mr. Williams Benn, who presided over the meeting at which Mr. Shaw-Lefevre delivered his views, contended that there could not be a greater mistake than to suppose that the recent short supply of water at the East-end was due to the action of the County Council. This plea was endorsed by Mr. Shaw-Lefevre, who claimed that the Council had endeavoured to deal with the whole question in a "statesmanlike manner." The Cabinet having preferred a Royal Commission to the immediate adoption of the Purchase Bills, Mr. Shaw-Lefevre hoped that at the first opportunity the electors of London would show their opinion of the conduct of the Government "in so wantonly "neglecting their interests." Such is the moral of the story; and the story is one which will be told over and over again prior to the next election for the London County Council. The Water Question serves a party purpose; and for this it will be employed.

Attention has lately been drawn to certain cases in which water is being derived from deep wells within Metropolitan limits. The practice does not possess any novelty; and the parade which is now being made of it points to two conclusions, one of which is certainly favourable to the Water Companies. If private firms think they can get a supply of water at a cheaper rate by sinking a deep well, and applying pumping machinery, than by drawing from the Company's mains, they are at liberty to try the experiment, as many have done in years gone by, when there was better reason for doing so than there is now. But the fact that there is a large supply of water to be obtained from the chalk is one of the contentions of the Water Companies, and has been enlarged upon by more than one Royal Commission. If private parties can pump from deep wells, much more can the Water Companies do the same thing. Major-General Scott, in the last annual report of the Local Government Board, shows that the supply which the Metropolitan Water Companies took from wells in the year 1883 was above 17 million gallons per day, and the bulk has been gradually increasing year by year until in 1895 the daily quantity exceeded 36 million gallons. A representative of "London" lately paid visits to certain of the principal hydraulic engineers in the Metropolis, and was told a few wonderful things —some of them true, and others a little erratic. He was assured that by the evidence given before the last Water Commission "it was sufficiently demonstrated that the "chalk could never supply anything like a fraction of the "amount required for daily consumption in a city like "London." It may be as well to know what the fraction really amounts to, so far as the present supply is concerned. Official returns show that the supply from wells belonging to the London Companies in 1895 was more

than 17 per cent. of the total. How much we might add for the quantity supplied by private wells is, of course, unknown. That much more might be obtained by an extension of the existing works belonging to the Companies is clearly put forth in the report of the Royal Commissioners. These authorities express their opinion that an average daily supply of 40 million gallons can be obtained from wells and springs in the chalk of the Lea Valley "without affecting any material interests." Also that a daily average supply of 27½ million gallons may be obtained from wells in the chalk area on the south side of the Thames in the district of the Kent Company. The Commissioners declare themselves further of opinion that a large supply of water might be obtained from the chalk area east of the Kent Company's district, in the basin of the Medway, and in the district farther east, "without any "risk whatever of damage to that area." There is more water in the chalk, therefore, than some of the skilled borers are aware of. Perhaps all they want to see, or to demonstrate, is that there is water enough to fill their wells, and not sufficient to make the supply common to all London through the medium of the ordinary mains.

One statement instilled into the ears of our contemporary's representative was that water obtained from the chalk possesses greater softness than that supplied by the Water Companies from the Thames. "In fact," said one member of a well-boring firm, "water from the chalk "is 10° less hard than Thames water." We have no other reason for objecting to the assertion than that it is ridiculously incorrect. Thames water is hard, but chalk water is harder. All the Thames Companies supply water of less than 20° of hardness. Water from the Lea Valley is about 2° harder. But the Tottenham water has 23° of hardness, and the Kent water—a true sample of what comes from the chalk—is between 26° and 27°. The water from the deep wells of the East London Company is of moderate hardness, but is quite 1° above the Chelsea supply. One gentleman informed the representative of "London" that, in order to be sure that the water they obtained came from the chalk, they sank their well so much the deeper. But the softness he spoke of, if it had any real existence, may be attributed to the descent of water from a stratum overlying the chalk. We have known a deep well in London supplying a water perplexingly soft; but the mystery was solved by the discovery that the upper water was not effectually cut off. There is some rather curious geology in the statements recorded by "London;" but we may attribute such vagaries to a slip of the pen, or a misapprehension on the part of the scribe. The discovery of the lower greensand at Loughton and at Windsor is interesting. On the whole, the story is not likely to do much harm, though it is intended for the reader to understand that there is water to be had for the digging—or boring—without paying anything to the Companies. Yet we have never heard of a London fire being put out by water from an artesian well. For that kind of service the Companies are, of course, expected to supply any amount of water without any kind of pay, and without any thanks.

British Association of Water-Works Engineers.—We learn from Mr. W. H. Brothers, the Secretary of the Association, that the annual meeting will be held in London from the 20th to the 23rd of July; and that active steps are being taken to obtain instructive papers for the occasion.

Paris Gas Company.—The dividend declared at the annual meeting of the Paris Gas Company on the 27th ult. was 65 frs. per share; the balance carried forward being 245,508 frs. (£9820). Last year the dividend was 64 frs. 50 c.; and the balance 174,321 frs. (£6973). The increase of revenue not only enabled the Directors to meet additional capital charges resulting from the last loan, but compensated for the depreciation in the value of residuals sustained by the Company as by other gas undertakings.

Patents in 1896.—The report of the Comptroller-General of Patents for the past year has been issued. He states that the number of applications, which in 1895 showed a decrease of 324 upon that of the previous year, increased in 1896 by 5132—being four times as many as the average yearly increment. During the last two months of 1896, the applications came in at the unprecedented rate of 700 per week; the total for the year being 30,194. He points out that the increase of 1896, like the decrease of 1895, was mainly in provisional specifications, which show an augmentation of 4677, or 22·6 per cent.; while complete specifications accompanying applications were greater to the extent of only 452, or 10·4 per cent.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 898.)

LAST week was naturally a quiet one on the Stock Exchange, consisting of only four working days with a holiday of four more at the end of them. In addition to this, there was still that large bump of caution displayed by the public that kept them from any tendency to adventure. The general feeling, however, was fairly good; the outbreak of actual hostilities on the Greek frontier being regarded with much less apprehension. Good investment stocks held their own pretty well; and traffic returns, and the expectation of good holiday business, supported rails. Special markets were badly affected by special circumstances. The Money Market showed a stronger disposition. In the Gas Market business was quiet, even after making allowance for the season; but the tendency appeared decidedly favourable. Changes in value are few in number; but they are substantial, and are all for the better. In Gaslights, the "A" opened unchanged. But it improved slightly in the course of the week; and the closing mark, 304, was the best. The quotation, however, remained unaltered. In the secured issues, only a few transactions were noted in the "J" 10 per cent.; but they were at pretty good prices. South Metropolitans were moderately dealt in, and gave no sign of moving. A single transaction in Commercial relieved it from stagnation. The Suburban and Provincial division was scarcely touched; but there was a rise in the price of Brighton and Hove original and of Croydon "B." Among the Continental Companies, Imperial was pretty active, and in better favour; the quotation making a further advance of 3 points. The announcement that at the approaching meeting the usual 5 per cent. dividend will not be augmented by the usual 1 per cent. bonus was considered quite as good as could be expected, having regard to the situation in Vienna. None of the rest presented any feature calling for observation. Buenos Ayres will maintain the 6 per cent. dividend for the year 1896. The Water Companies were fairly quiet. The tendency was not very good; and Chelsea had a relapse.

The daily operations were: Business in Gas was moderate on Monday; and prices mostly ruled steady. There was a rise of 3 in Brighton and Hove original; and 1 in Imperial Continental. Tuesday's transactions were much about the same; and prices were disposed to be a little better. The only change in quotation was an advance of 3 in Croydon "B." In Water, Chelsea ordinary was 3 lower. Business was getting quieter on Wednesday; but the tendency showed no falling off, while Imperial Continental gained 2 more. The level of transactions was well maintained; and prices were good. All quotations were steady and unchanged.

ELECTRIC LIGHTING MEMORANDA.

Major Cardew's Report on the Hampstead Fatality—The Danger of High-Pressure Supplies—The Mystery Dissipated—Electrical Heating on the Grand Scale.

MAJOR CARDEW'S report on the fatal accident at Hampstead, noticed in the "JOURNAL" last week, is strongly condemnatory of the arrangements by which the electrical distribution in this district is carried on. The accident was mentioned in this column on the 16th ult. Major Cardew finds, in the first place, that the man White was killed by an electric shock, which he encountered in one of the street transformer stations. These are described as small chambers under the pavement, in this case only 6 ft. 6 in. by 5 ft. square, and 6 ft. 6 in. high to the crown of the arch. Two transformers, of 25 kilowatt and 18 kilowatt capacity respectively, were contained in this chamber, placed one on either side of an iron ladder, by which access was obtained to the interior. White's duty at the time was to empty the drip-pans placed under the cover of the chamber to catch the rain water. It was a wet day, the man's boots were very wet, and so were his hands. He entered the chamber by the iron ladder, which was in contact with the wet earth; and while he was holding on to the rungs, he put one foot upon the flat top of a transformer case. This case was evidently at the time charged to a high potential from earth; and the unfortunate man's body made a short circuit between it and the ladder. Thus he received the fatal shock—his hands and foot being at the same time badly burnt. The only question left in doubt at the inquest, it will be remembered, was as to how all this could have occurred, inasmuch as what were imagined to be the necessary and sufficient precautions for the prevention of any such accident were stated to have been taken in the design and construction of the chamber. Major Cardew observes that it should have been impossible for such a catastrophe to occur but he reports with regret that, as a matter of fact, the precautions taken were insufficient and illusory, and, moreover, were not in accordance with the system of supply approved by the Board of Trade. It is pointed out that the transformer case ought to have had an efficient earth connection, so that it could never become charged with electricity to a dangerous amount. In the present instance, the only earth connection made was to

an iron bolt let into the wall of the chamber, which supported an insulator. This bolt could at best have a very limited extent of surface in contact with moist earth; and Major Cardew does not think it would have been considered sufficient even for telegraphic purposes. "Jerry work" again, evidently. The transformer case got its charge from a place in the high-pressure connecting line, where the insulation had become damaged by contact with the edge of the inlet-hole. This was a sharp metallic edge, round which an ordinary india-rubber covered wire had to be passed and bent downward at right angles to reach the high-pressure terminal below. As the Inspector remarks, such an arrangement was well calculated to produce the fault that actually occurred.

In face of this discovery, it is not to be wondered at that the report should proceed to argue that the employees of electric light undertakings using high-pressure currents are exposed to such dangers, that the inclusion of these establishments in the category of dangerous trades for the purpose of official regulation and inspection is urgently called for. It is known that the Government have their eye upon these undertakings; and though our electrical contemporaries jeered at the suggestion that an electric lighting installation could be regarded as a place where a dangerous trade, within the meaning of the Act, is carried on, they must now "sing small" upon this theme. It is unnecessary to repeat here the specific recommendations with which Major Cardew's report concludes. He remarks upon the restricted size of the Hampstead transformer stations, which renders it hardly possible to provide against every unseen and unsuspected danger that may surround a man who has to enter these potential death-traps; and this is a point of practice in regard to which Hampstead is not singular. In commenting upon the report, the "Electrical Review," with habitual candour, admits that the severity of its strictures derives additional force from the consideration that the Board of Trade are usually indulgent to electrical enterprise. Our contemporary bows to the Inspector's conclusions, and admits that if the Board of Trade regulations attached to the Hampstead Order had been properly carried out, this sad casualty would in all probability have been prevented. The requirements in question were general enough to escape the reproach of grandmotherly interference which is so often hurled against official restrictions of the kind. All that was presented was that all metal used in the construction of the transforming stations, and all exposed metal contained within them, was to be electrically connected to the armouring of the mains, and, further, that all the high-pressure conductors and apparatus were to be so protected as to prevent danger from electric shock. The means by which these ends were to be ensured was left an open question; and this confidence in the undertakers has proved misplaced. This is the very way to bring in grandmotherly government in its most rigorous and irritating form.

We have no desire to see electric lighting undertakings put in leading-strings; but some electricians are so prone to be hard upon the gas industry on the score of its imagined inferiority, in the matter of safety, to electricity, that we are naturally solicitous to see the rights of the question of public security placed in the correct light. The British public, very justifiably, have declined to make things easy for the electrical interest by tolerating overhead wire systems of distributing light and power. The putting of electric mains and connections underground has so far proved the correct course; but it involves a number of special considerations which can only be disregarded at the extreme peril of those who are responsible for, or are exposed to the consequences of, this neglect. How would the man who designed the Hampstead transformer chambers, and passed their slipshod construction, like to be condemned to work in them? This is a consideration that should be kept in the forefront of all such dispositions. It is all very fine for a designer to sit at his ease in an office, and cut down dimensions and omit safeguards with a view to saving expense; for this is what it all means. Not one-half of the local authorities who have been beguiled into undertakings of the kind would have done so if they had known at the beginning what the bill would amount to before the job was completed. The temptation to cheeseparing is thus very great; and it is apt to operate in the more secret places of the installation. Brass-mounted engines and a glittering switchboard at the station are very imposing; but the street-work has too often to suffer for them. Without labouring the Hampstead incident further, it is with much satisfaction—the only satisfaction, indeed, to be derived from the melancholy business—that we are able to record the dissipation by Major Cardew of the mystery with which the Coroner's inquest left the case surrounded. It is always most regrettable when the cause of any industrial catastrophe is left in the dark. When the source of mischief is known, repetition of the evil consequences may be guarded against; but a mystery demoralizes men, and prepares for its own continuance in pernicious potentiality. It is a good thing, for many reasons, that the causes of the Hampstead affair have been cleared up. As the "Electrician" observes, "electrical engineers cannot too soon recognize that their standard of safety must be higher—much higher—than that of the earlier born industries; and that, since mankind has not as yet evolved an electrical sense, men moving about among high-pressure conductors are exposed to peculiar dangers, against which it is absolutely necessary to take peculiar precautions." There must be no shirking the requisite outlay in order to make electricity generation and distribution safe before economical.

An interesting example of house warming by electricity is supplied by the station and offices of the Niagara Falls Power Company. Power being, of course, "no object" in this magnificent establishment, electricity is solely employed in heating the dynamo room and offices. It appears to be possible to get rid of a good deal of surplus energy in this way. Electrical heaters are simple pieces of apparatus, consisting mainly of coils of wire made hot by the current forced upon them. They are, in effect, overloaded resistances. The dynamo-room at Niagara Falls is fitted with fifteen heaters, which dissipate about 600-horse power if used all together. This has, however, not been necessary hitherto, thanks to the assistance rendered by the great dynamos, of which two are usually in action. These are of 5000-horse power each; but assuming them to be worked at 4000-horse power instead of their full capacity, it is calculated that at least 3 per cent. of the energy is lost in heat. This makes the contribution of each dynamo to the general heating effect not less than 120-horse power; so that from the two machines generally in use 240-horse power in the form of heat would be obtained. It would appear from this statement that the Niagara power-room must be rather more than cosy in summer time. The offices of the establishment require 175-horse power to heat them comfortably during the "zero weather," which is the regular datum of American heating engineers. One apartment, measuring about 20 ft. by 15 ft., and not more than 10 feet high, requires two heaters, dissipating 7-horse power each, to make it comfortably warm. There is nothing at all niggardly about these figures. Evidently, the science and practice of electric heating, as understood by the Niagara Power Company's officials, are to be classified as magnificent, but scarcely as offering a prospect of good business in the estimation of those who would have to derive the necessary electricity from some other source.

THE PRESERVATION OF METALLIC STRUCTURES.*

THERE is no heavier responsibility in the whole range of engineering experience than that of the designing and care of metallic structures so that they will stand and continue to endure for as long a period as may be required. Modern civil engineering differs from the old in nothing more than in the more perishable nature of the materials with which the engineer has to work at the present day, as contrasted with the character of the substance of the monuments that his precursors were empowered to raise. It is not merely a question of the difference between a gasholder and the pyramid of Cheops, but also of the contrast between the Roman aqueduct and the Forth Bridge. Hence the modern civil engineer has to consider, in relation to the structures he has to design, what portions of them are likely to decay first, and how. This solicitude is not confined to metallic structures, though in these it finds its hardest problems. Most of the structural materials employed in modern engineering are artificial, and therefore charged with the potentiality of disintegration in a way that natural products do not illustrate. Of all artificial engineering structural materials, however, iron and steel are the most perishable. Unless the greatest care was taken to prevent it, the iron and steel required for the making of an important bridge or gasholder would perish before it could be built into the structure; and from the completion of its manufacture to the end of its service, such materials need incessant care to protect them from the effects of their own natural composition.

The preservation of iron and steel structures, to use a paradoxical expression, must begin before they are erected. That is to say, the designer must have in mind the nature of the materials with which he has to deal, and must consequently so dispose his scantlings that the exposed surfaces may be accessible for purposes of preservation. Wherever corrosion can occur, there the paint-brush must be able to go; and wherever this golden rule is broken, the seeds of ruin are sure to be sown. A book like this of Mr. John Newman is not required to deal with engineering design. It naturally assumes the construction of metallic structures in a sound and workmanlike manner, and begins with the work of the scraper and painter, where the erector leaves off. This is just the opening which carelessness or inexperience so often leaves for mismanagement. The painting of ironwork is apt to be looked upon as something beneath the solicitude of an engineer, because it is not a subject of instruction in the strict engineering curriculum. The young engineer is fond of talking about strains, and is not above taking out weights; but the idea of the painting seems a very petty thing in comparison with these lofty cares of the professional man. Maintenance, however, is fully as important as design in the estimation of those by whom engineers are employed; and for this reason, a book on the subject should not be lost upon those whose instruction is only too often rather bookish than practical.

At the first glance, Mr. Newman appears to demand attention as a practical man—so practical, indeed, that he cannot

* "Metallic Structures: Corrosion and Fouling, and their Prevention. A Practical Aid-Book to the Safety of Works in Iron and Steel, and of Ships; and to the Selection of Paints for them." By John Newman, Assoc.M.Inst. C.E. London: E. & F. N. Spon; 1896.

write good English. His style is painful. Surely none but a very practical person should expect to be pardoned for such a paragraph as the following, which we extract from Mr. Newman's preface: "It should always be remembered that the preservation of a metallic structure is only second in importance to that of its design and erection, and, unless corrosion and fouling are prevented or repressed, the time must come when the original strength will be so impaired as to be dangerous." In passing the rest of his book in review, therefore, it must be understood that we are continually required to exercise considerable care in puzzling out the meaning from a discouraging succession of clumsy and involved sentences. Take, for example, this, from the first page of the book: "The process of oxidation has become visible on metals when they have become tarnished, but a metamorphic condition will have occurred before its effects are apparent, and under the surface it may be proceeding rapidly and spreading around, such decomposing action frequently having nuclei from which its power springs." It will be seen, by this extract, that Mr. Newman is not what one would call an engaging writer. Unfortunately. the author's arrangement of his matter is as unsystematic as his diction is foggy. Honestly, we cannot recommend anybody to purchase this book. It is one of those perfunctory exercises in bookmaking which one can easily do without. Moreover, all that is necessary to be said about the causes and prevention of corrosion in metallic structures can be stated within the compass of an ordinary paper or lecture; and this has been done acceptably over and over again. It is quite unnecessary to import into the discussion of this subject such hazy observations as that "a certain percentage of carbon makes steel hard, but steel having comparatively little carbon is not so." We do not say that there is not in Mr. Newman's book plenty of good advice taken from ancient and modern technical records; but as a compiler and annotator—to say nothing of criticism—he is not satisfactory.

PERSONAL.

Probate has just been granted to the Executors of the late Mr. JOSIAH HARDMAN, chemical manufacturer, of Wetley Abbey, Chuddleton, Staffordshire, and of Milton, Stoke-upon-Trent, who left personal estate of the gross value of £28,070, and of the net value of £12,074.

At a meeting of the Directors of the Chatham, &c., Water-Works Company last Tuesday, the offer was accepted of a portrait of the late Captain BUDDEN, who was for many years Chairman of the Company, to hang in the Board-room. The portrait, which is presented by Major Austen Budden, will make a companion to that of the present Chairman, Mr. J. Baird.

Mr. C. J. BATLEY, Assoc.M.Inst.C.E., has been appointed by the Oldham Corporation Water Committee to succeed Mr. W. Watts in the position of Engineer to the department. During the past seven years, Mr. Batley has been Assistant Water Engineer to the Corporation of Bury. Previous to that he had a varied experience in water-works construction while serving as an assistant to Messrs. G. and G. H. Crowther and Messrs. T. and C. Hawksley.

OBITUARY.

The death has just taken place of Mr. S. CHERRY, of St. Albans, who had attained the ripe age of 89. Deceased was for upwards of thirty years a Director of the St. Albans Gas Company.

Mr. W. MINTER, whose death is just announced at the age of seventy, was one of the originators of the Wickham Market Gas Company, and for many years occupied the position of Managing-Director of the Company.

The European Gas Company, Limited, have sustained a great loss in the death of M. ALEXANDRE COINDET, their Manager at Havre. Deceased had been connected with the Company for nearly forty years. He was a prominent member of the Société Technique de l'Industrie du Gaz en France; and at the meeting of the Society last year he was re-elected one of the Committee. His communications to the Society will possibly be remembered by readers of the "JOURNAL." He is replaced by M. Gaston Gautier, who has for upwards of thirty years been identified with the gas industry both in England and in France.

Acetylene in Saxony.—The Government authorities of Saxony have issued a series of regulations with regard to the manufacture and use of acetylene in the kingdom.

The Export of Petroleum from the United States.—It appears from recent returns that the petroleum exported from the United States during the past year was the largest in the history of that important commodity. The shipments of the crude product reached a total of 117,921,276 gallons, which shows an increase of 1,967,145 gallons over the exports during 1895. Of naphthas, there were exported 13,420,769 gallons; being an increase of 662,829 gallons. The shipments of illuminating oil amounted to the enormous total of 749,305,844 gallons; showing the increase to have been 71,805,197 gallons. The total shipments of all petroleum products reached a total of 931,785,022 gallons; the increase over 1895 being 78,658,892 gallons.

COMMUNICATED ARTICLE.

THE USE OF "MANJAK" IN THE MANUFACTURE OF COAL GAS.

By JOS. HARGER PYE,
Engineer and Manager of the Barbados Gas Company.

I have read with considerable interest the articles which have recently appeared in the "JOURNAL" upon the testing of gas coals. Being situated in a locality plentifully supplied with a natural bituminous pitch, which in Bardados goes by the name of "manjak," I had hoped to be in a position to add a paper upon the "Testing of Manjak;" but the defective condition of our manufacturing plant, and my inability to fix up an experimental one, prevent me from doing so. A few remarks upon the general characteristics of manjak and the results obtained from it, when compared with those secured from ordinary caking coal under similar circumstances, although being no basis upon which to fix the exact value of manjak, may, however, serve to introduce the general properties of the material.

Manjak is of black colour, possessing high lustre, having a bright conchoidal fracture, in appearance closely resembling newly broken pitch. In Barbados it is found very near, and sometimes upon, the surface of the ground, in seams varying from 1 to 2 feet in thickness, running usually at an angle of about 45° and in close proximity to rocks. It is supposed to have been formed by the drying up and consolidation of petroleum oil, which occurs in abundance in the same localities, and is often seen oozing out of the ground or floating down the streams. It is similar to the Trinidad pitch, Utah "Gilsonite," and Mexican "Albertite;" but it is much superior in quality to any of these. The following analysis is not of much value to the gas manufacturer; but being the only one I could obtain, I give it to show the small amount of ash:—

Moisture	2·00
Volatile organic matter	70·85
Non-volatile organic matter	26·97
Mineral matter	0·18
	100·00

Manjak has, under different names, been used in the insulation of electric wires, in the manufacture of varnishes, as bituminous concrete in asphalte roads and pavements, and as patent fuel when mixed with peat or other organic matter. For some time past, in the localities in which it is found, it has been customary to throw a handful of manjak into the furnaces upon the sugar estates; but it has never proved a success when used in its present state as fuel, on account of its tendency to choke the furnaces with thick tar. It has also been tried in several forms upon railway engines, but has been condemned for the same reason.

Since my arrival here, I have been anxious to make a trial of manjak in the manufacture of gas; but owing to the unfortunate condition of the works, combined with the lack of any apparatus to weigh the material used, or to measure and test the gas made, I was unable to form any idea of its gas producing properties, though by experimenting with a small quantity of it, the quality of the gas appeared to be very materially improved. I have now made extensive alterations and additions to our plant, and have been enabled to make a more careful experiment upon the use of manjak. The cause of failure in the use of this material for fuel seemed to me to lie in the fact that it had only been subjected to comparatively low temperatures when burnt; and I determined to carbonize it at the highest temperature attainable. This idea was strengthened by the success with which I had previously used small quantities in the top retorts. Its appearance led me to suppose that, if carbonized at a low temperature, a large amount of tar would be formed, and would give rise to difficulties with stopped ascension-pipes; and upon experiment I found this to be actually the case. Since then I only used manjak in retorts which had attained a temperature of nearly 2000° Fahr., so far as I could judge by the naked eye.

I would add that owing to the state of the works generally being still very defective, I am unable to produce more than 9000 cubic feet of 17-candle power gas per ton of Wigan Arley coal; and I do not assume, in presenting the following figures, to make an accurate report upon the value of manjak, but simply to introduce the subject in the form of comparison between the results obtained from Arley coal and from manjak under similar circumstances. In the test referred to, small charges of manjak of 80 lbs. each were carbonized for six hours before being completely burnt off. The manjak was carefully handpicked, so as to remove all stuff and dust and preserve the stokers from the intense heat produced when charging with very fine manjak.

Before commencing the test, the gasholder was practically emptied, and six tests of the illuminating power of the gas at the outlet of the holder were made during the day; the average of the six tests being taken. The coke was water slacked and dried before weighing. There was unfortunately no means of measuring the amount of tar and liquor formed; and I had to entirely ignore these valuable products, though I had reason to suppose that a larger quantity of tar was formed than would have been from coal. The rapidity with which the gas was evolved during

the first three hours of the charge, necessitated regulating the exhauster to draw ¾ inch vacuum, instead of working with a level gauge as usual; and this caused a slight suction of air through the leaky condensers, which reduced the illuminating power of the gas somewhat. As it was, I obtained 13,324 cubic feet of 43·85-candle power gas per ton of manjak; and under more favourable circumstances, far better results might have been obtained. The illuminating power was tested in an Evans closed 100-inch photometer, in a room so well ventilated that the candles in no case consumed less than 36·5 grains; the average being 38 grains. The gas was burnt in a standard argand burner, at the rate of 1·8 feet per hour, in order to bring the lights as nearly equidistant from the disc as possible; and the consumption was corrected in the usual manner for temperature, pressure, and humidity.

Now, 1000 cubic feet of 17-candle power gas, as usually supplied, is equivalent to $\frac{1000 \times 17 \times 120}{5 \times 7000} = 58{\cdot}28$ lbs. of sperm; and as the selling price per 1000 cubic feet in Barbados is 8s. 4d., I have taken the value of 1 lb. of sperm at $\frac{1000d.}{58{\cdot}28} = 1{\cdot}7d.$

Hence the value of 1 ton of Arley coal, producing 9000 cubic feet of 17-candle gas, is—

$\frac{9000 \times 17 \times 120}{5 \times 7000} \times 1{\cdot}7d.$	£	3	14 3
14 cwt. coke at 23s. per ton		0	16 1
Tar and liquor not valued			—
	£	10	4

Manjak at 13,300 cubic feet of 43·8-candle gas—

$\frac{13{\cdot}300 \times 43{\cdot}8 \times 120}{5 \times 7000} \times 1{\cdot}7d.$	£	14	2 11
9 cwt. coke at 10s. per ton.		0	4 6
	£	14	7 5

Taking Arley coal at 25s. per ton, which is the lowest price delivered at the works, the comparative value of manjak would be—

£4 10 4 : £14 7 5 :: £1 5 0 : x

x = £3 19s. 6d. per ton, which is a little more than three times the cost of coal. The coke produced from manjak is very small, friable, and porous, and is of little value; hence I have put it down at 10s. per ton, as against 23s. which we realize for good gas coke. As will be readily seen, these figures are at best only approximate, and apply to the prices prevailing in Barbados which are very different from those in England.

In conclusion, I do not consider manjak suitable for taking the place of gas coals or cannels entirely, on account of the difficulty of charging, the rapidity with which the gas is evolved, and the high illuminating power of the gas produced; but it seems to rank very high as an enricher of coal gas. When well mixed in small quantities with the charges of coal, it is very easily handled by the stokers; and it would be interesting to follow a series of experiments upon the increase of illuminating power when using different percentages of manjak.

Books Received.—"Plumbing: A Text-Book to the Practice of the Art or Craft of the Plumber, with Supplementary Chapters upon House Drainage." By the late W. P. Buchan. Seventh edition, re-written and greatly enlarged. (London: Crosby Lockwood and Son.) "The Municipal Year-Book for 1897." By R. Donald, Editor of "London" and "The London Manual." (Offices of "London," 125, Fleet Street, E.C.)

German Association of Gas and Water Engineers.—The thirty-seventh annual general meeting of the Association will take place from the 15th to the 19th of June next, at Leipsic. The official announcement of the meeting contains a suggestion that those present should remain at least one day longer in the town, for the purpose of visiting the Saxony-Thuringian Exhibition, which will then be open there. The nature of the papers to be read at the meeting will be made known later.

The Chairmanship of the Royal Commission on the Water Supply of the Metropolis has been accepted by Lord Llandaff, better known as the Right Hon. Henry Matthews, Q.C., who was Home Secretary in Lord Salisbury's Second Cabinet (1886-92). Among the names suggested was that of Lord Rathmore, who, as the Right Hon. David Plunket, presided over the House of Commons Committee on Water Supply two years ago; but it is understood that he was not willing to serve.

The Late Mr. P. J. Salmon.—The following resolution has been unanimously adopted by the Committee of the North of Ireland Association of Gas Managers, on the motion of Mr. T. Frizelle, of Holywood, seconded by Mr. M. Martin, of Drogheda, the past and present Presidents of the Association: "The Committee of the Association desire to place on record an expression of their sincere regret at the loss occasioned by the death of their esteemed colleague—a Past-President of the Association—Mr. P. J. Salmon, Manager of the Galway Gas-Works, and also of their sympathy with his widow and family in their sad bereavement; and they request the Hon. Secretary will forward a copy of this resolution, along with a cheque for £10 out of the funds of the Association, to Mrs. Salmon.—Jas. Whimster, Hon. Sec. 1st April, 1897."

TECHNICAL RECORD.

THE INSTITUTION OF GAS ENGINEERS.

The Programme for the Forthcoming Meeting.

In the "JOURNAL" last week we gave a brief forecast of the programme for the forthcoming general meeting of the above-named Institution, which will take place at the Institution of Civil Engineers on the 5th and 6th prox., under the presidency of Mr. Corbet Woodall, M.Inst.C.E. We have now received from the Secretary (Mr. Thomas Cole) an advance copy of the programme, which presents some interesting features. On the first day, the business will open with the presentation of the Council's report and statement of accounts, the election of members, &c. The Inaugural Address will then be delivered; and this will be followed by the presentation of the report of the Committee on Standards of Light. The reading and discussion of papers will then be commenced. The first on the list is one by Professor Smithells, of the Yorkshire College, Leeds, on "The Luminosity of Flame." Mr. F. D. Marshall, of Copenhagen, will follow with a paper on "Modern Machinery for Handling and Storing Coal." This will complete the day's work; and in the evening the members will dine together at the Trocadero Restaurant. On the second day, the following papers will be taken: "The Carburation of Coal Gas," by C. E. and C. F. Botley; "Another Step in Promoting the Union of Capital and Labour," by G. Livesey; "On Cyanides," by G. P. Lewis; "The Amsterdam Gas-Works," by H. Salomons. On Friday, the 7th, visits will be paid to the station of the Hydraulic Power Supply Company at Wapping, to the Rotherhithe works of the South Metropolitan Gas Company, and to the Thames Iron-Works. The hydraulic power works were established in London by the President, in conjunction with Mr. E. B. Ellington, M.Inst.C.E., in the year 1882; and the Company have now four large stations, containing in all 3800-horse power, and upwards of 90 miles of mains, from which are worked about 3000 machines, principally lifts and cranes. The capital outlay on the works has been £550,000; and the gross revenue is about £70,000 per annum. At the Rotherhithe works, Foulis machine stoking, as well as hand stoking, is employed; the coals and coke are lifted by hydraulic power; and the ships are in part discharged by grabs. The gasholders at these works have the shortened guide-framing. The objects of interest at the Thames Iron-Works will include the first-class battleship *Albion*, in course of construction, and the commencement of the keel of a new battleship, of 14,850 tons displacement, for the Imperial Japanese Government. Hone's patent grabs will be seen at work lifting the different kinds of material for which they have proved so successful. The visit to the Engineering Department will include the iron and brass foundry, and the boiler and engine shops. The Company's dry docks, sawmills, and central electric lighting station will be inspected. Light refreshments will be provided. After leaving these works, a trip will be made down the river as far as Gravesend; and during the run the members will lunch at the invitation of the President.

THE EXPLOSIBILITY OF LIQUID ACETYLENE.

At a recent Meeting of the Nottingham Section of the Society of Chemical Industry, a paper on the above subject was read by Dr. FRANK CLOWES, Professor of Chemistry and Metallurgy at the University College, Nottingham. The following abstract thereof, with the brief report of the discussion, appears in the current number of the Society's "Journal."

The author, after referring to a former paper communicated by him to the Section, stated that M. Pictet now prepares acetylene gas in a dry state, and in an absolutely pure condition. He maintains that in this state the gas may be safely liquefied by compression, and then stored, transported, and used for illumination. The pure gas possesses a distinct, but not unpleasant, smell; and it does not produce any chemical action upon metals. It appears to give rise to no danger from explosion. According to the researches of Professor Dixon and of MM. Berthelot and Vieille, a local source of energy, such as an electric spark, an explosion of fulminate, or a source of heat of sufficient intensity when applied to acetylene gas under atmospheric pressure, does not produce explosion throughout the whole volume of gas, but only immediately around the source of energy. An illustrative experiment made by the author when communicating the paper, however, proved that an explosion caused by the firing of fulminate in a small quantity of acetylene gas would develop very great energy—a glass vessel being shattered, and the glass fragments being driven through a metal screen. On the other hand, the researches just referred to prove that acetylene gas, when compressed to two or more atmospheres, is exploded throughout its mass by the local means stated; and under these conditions a very dangerous pressure may be developed.

Liquefied acetylene is a substance of considerable scientific interest. It exerts a pressure of about 30 atmospheres at ordinary temperatures. It is the lightest liquid known, and has the

greatest co-efficient of expansion of any liquid or solid with which we are acquainted. It is also possessed of less refrangibility than any known liquid or solid. It furnishes about 300 times its volume of gas by evaporation.

As regards the explosibility of liquid acetylene, it is conceded that, under suitable conditions, it explodes *en masse*. Unfortunately, numerous serious and fatal explosions have occurred from liquid acetylene; but their extraordinarily destructive effect has led to considerable difficulty in tracing the precise cause of the explosion. In a recent explosion in M. Pictet's own laboratory, the origin has been attributed to the fact that workmen neglected to pump out the acetylene from a steel cylinder before its cap was unscrewed; and the use of a spanner on the cap appeared to develop sufficient heat to explode the acetylene. In a more recent explosion in Berlin, it was said to be started by friction. Until the possible causes of explosion are more fully known, it seems impossible to feel that the liquid is safe for ordinary purposes.

M. Pictet describes the precautions which he has taken in order to avoid risks of explosion during the preparation and liquefaction of the gas. The gas must be pure, and must be cooled during the process of compression. In order to obtain the gas with safety in a pure state, the lumps of calcium carbide are allowed to fall into cooled water, so as to be at once entirely immersed; and the gas is then purified by passage through dilute sulphuric acid, calcium chloride solution, solution of a lead salt, and solid calcium chloride. All these purifying substances must be kept cool. The impurities thus removed are mainly ammonia, arsine, phosphine, hydrogen, sulphide, hydrocarbons, and moisture. The dry, pure gas is then stored over heavy petroleum oil.

M. Pictet attributes the intense light of the flame of acetylene to the same cause as the explosibility of the gas—dissociation into its elements, with production of a temperature exceeding that of the electric arc. This dissociation occurs very near the base of the flame, and only after the elements have cooled can they subsequently undergo ordinary combustion in the higher part of the flame.

In the discussion upon the paper,

Dr. J. D. Granger, who had just returned from Berlin, referred to the extensive character of M. Pictet's work in this matter. Unfortunately, two most serious explosions had taken place in Pictet's own laboratory in Berlin. It had been found that friction was more likely to explode acetylene than any other cause, especially when it was in a liquid state. In this condition the friction caused by opening the valve was enough to bring about an explosion. That the acetylene was split up into its component parts, hydrogen and carbon, during the explosion, was proved by the large quantity of carbon found subsequently in the cylinder. M. Pictet had succeeded in removing most of the impurities; but there was one, and that a very dangerous one, which he had not proved to be removed—viz., phosphoretted hydrogen. M. Pictet had passed the acetylene through a solution of lead acetate or lead nitrate, and this would probably remove much of this impurity. It was necessary, however, to remove every trace of it, or there was great liability to explosion. One thing that was most lamentable was that they did not know exactly what had given rise to most of the explosions. In some cases, they seemed to have happened without any apparent cause. It had been stated several times that acetylene gas acted on copper. But this was chiefly owing to impurity; and copper could be replaced by some other metal, such as nickel, in order to avoid this danger. From all that was known, there could be no doubt that in the near future acetylene would replace in certain cases, or supplement the use of, ordinary gas; but there were many things it could not do. At the present time, it had one great competitor, and that was the incandescent light. The insurance companies on the Continent were beginning to issue policies under which provision was made for lighting houses with acetylene; but the restrictions were so great that only a few people availed themselves of them. Until more experiments had been made on the explosiveness of acetylene, it was hardly likely to come into general use.

Mr. Golding asked whether the heat of its combustion was not an objection to the domestic use of acetylene. Again, if the burner were tilted on one side so that a part of the flame impinged against it, would not the extreme heat of the interior of the flame fuse its orifice?

Mr. H. Forth said he believed English insurance companies had absolutely refused to allow the gas to be used. They would have nothing whatever to do with it.

Mr. F. J. R. Carulla asked in what proximity it was necessary to have the fulminate, in order to produce an explosion.

Dr. Clowes, in reply, said he could not give any information on the last matter. With regard to Mr. Golding's questions, they had tried the flames, and had found, as a matter of fact, that they could hold their hands much closer to the acetylene-flame than to the ordinary gas-flame, for the heat disseminated in the air was much less. They had never had the difficulty of the burner being sealed up; but supposing the jet were tilted one way or another, he did not think it would play upon the jet, since the flame was a stiff one on account of the high pressure under which the gas issued. He knew that there had been no trouble arising from this cause.

GASEOUS FUEL AS A MEANS OF CHEAPENING ELECTRICITY.

The following are the principal portions of a paper on the above subject read by Mr. Nelson W. Perry before the United States North-Western Electrical Association at Milwaukee:—

In these days of extending areas to be reached by electric light and power companies, the management is constantly being put into a quandary as to how they are to be reached. In electric lighting enterprises employing the direct current, the areas that can be economically reached are already pretty well covered; and these are the best paying areas. Just beyond, there is new business to be had if it could only be supplied; but to supply it would involve additional outlays far out of proportion to the reasonable expectation of immediate returns. The management therefore feels that it must, for the present at least, forego the immediate increase from these outlying districts, and must depend for new business upon the natural or stimulated growth of custom within the districts already partly supplied.

Where the alternating current is employed, very largely increased areas are so easily made tributary to the central station that the temptation to supply scattered customers has been, in most cases, too strong to be resisted; and I believe, if reliable statistics could be compiled, they would show that alternating current lighting stations have proved far less profitable as a class than have those using the direct current—the very limitations which have prevented the direct current entering the field to which the alternating current is best adapted having proved its greatest safeguard.

A comparative study of a very large number of load-lines of direct and alternating current lighting stations discloses a peculiar state of affairs—viz., that, as a rule, the alternating current load-lines have almost uniformly a squarer and broader topped peak than have the direct-current stations. This is largely due, in some cases, to the fact that in the scattered service of the alternating current a very much larger proportion of the total output is employed for street lighting, but it is also partly due to the undoubted fact of the larger proportionate losses at light loads due to transformer and other losses peculiar to the alternating current, which makes the mean load higher than it should be. This feature is particularly observable in the curves of an alternating current station of which I have diagrams for nearly every day in the year, which supplies such a small proportion of its total output to street lights as to render the effect of this practically negligible. With the direct-current system, the introduction of high-voltage lamps, which have already demonstrated their feasibility abroad, and to a less extent in the United States, will be a partial solution of the question of supplying greater areas, if it does not lead to the same temptation which has beguiled the manufacturers of alternating current, for of this there is constant danger.

The electric lighting industry in the United States is, even at its best, on an unsatisfactory basis, and something must be done to better it. In the most desirable locations, which are in the largest trade centres, such as Chicago, New York, and Boston (where probably of all places in the world the electric lights are most dense, and therefore where they can be supplied at least cost for distribution), what do we find? We find those companies whose shares are selling above par, and who are paying dividends regularly, making new issues of stocks and bonds, or applying for permission to do so, in order "to raise funds for extensions."

Take the New York Edison Illuminating Company as an example, whose stations are perhaps as favourably located as are any to be found, and whose stock is selling above par. It has a share capital of $10,000,000, of which $7,938,000 has been issued; and of debenture bonds $7,118,000, of which $6,430,000 has been issued—making a total authorized capital liability of $17,118,000, of which $14,368,000 has been issued. According to the report for 1895, the total maximum capacity was 75,000 ampères, or the equivalent of 150,000 16-candle power lamps. According to Mr. J. W. Lieb, the load factor of the combined Edison stations on the day of the greatest output in 1894 (Dec. 10) was 34½ per cent.

To compare the capital outlay for an electrical service with that required for an equivalent gas service, is exceedingly difficult—first, on account of the paucity and unreliability of gas statistics; and, secondly, because of the well-known enormous over-capitalization of gas enterprises in New York, partly due to the watering of stocks, and partly to the duplication of plants that would have been totally unnecessary had the gas industry grown legitimately under a single head, instead of being the outgrowth of repeated consolidations of competitors in the same territory. But taking these statistics as we find them, the total authorized capital of the various gas companies, including stock and bonds, is given as $58,109,000; and their united annual output, as near as I can get it (an average of two estimates by different gas authorities), 14 billion cubic feet. This gives a mean output per hour of 1,600,000 cubic feet. Reckoning 5 cubic feet per hour as the equivalent of a 16-candle power incandescent lamp, this means an average supply of 320,000 lamps; and if the load factor be assumed to be the same as given for the Edison stations, it means a maximum supply for something more than 927,000 burners. This is in round numbers 6·2 times as many lights as the Edison Company, on a total authorized capitalization of $17,118,000, are able to

supply. On this basis, the capitalization necessary to supply the same number of lights as the gas companies can now furnish would be $106,000,000, as against $58,000,000 for the gas companies. For many reasons, some of which have been specified, the comparison is manifestly unfair to gas; and it seems not at all improbable that gas service can be supplied on a capitalization which does not exceed one-fourth (instead of one-half, as shown above) that required for equivalent electric service.

There is certainly something wrong in this state of affairs, which the electrical engineer must correct. The most significant feature of the situation is that, notwithstanding the fact that gas is distributed over very much greater distances than are low-tension currents, the consumer can buy it so cheaply that he can produce electric light more economically by burning it in a gas-engine, even after incurring the losses in conversion in the engine and dynamo, than he can buy it from the electric company. If this be true in large cities like Chicago, New York, Philadelphia, Brooklyn, and Boston—and it cannot be gainsaid—what must be the condition of light and power plants in smaller and less favourably situated cities? Some, by rigid economy and the best of management, are making a little money; some are running on a very close margin; and still more are undoubtedly eking out a precarious existence while their machinery is wearing out, and making no provision for its replacement when it requires renewal; and all are charging more for their light than gas can be, and is, furnished for, where gas is furnished at all. It is very clear that, if the electric light could be supplied at the same price as gas, and at the same time produce a profit, it would provide an enormous increment to the electric light manufacturers' income.

Our electrical engineers have bent every effort to ameliorate matters; and the best of our electrical stations are now models of mechanical and electrical engineering skill. Electricity can be produced at the station by large compound condensing engines more cheaply than can gas at the gas-works. If we assume that illuminating gas costs but 20c. per 1000 cubic feet to manufacture, and that 5 cubic feet per hour are consumed to produce 16-candle power, the cost per light per hour at the gas-works would be $\frac{1}{10}$c. If, on the other hand, we assume that an electrical horse-power-hour can be produced at the central station for 1c., and that thirteen 55-watt lamps can be supplied thereby, they would cost $\frac{1}{13}$c. per hour. When we still further consider that recent tests in England have shown that a brake horse power can be produced under test conditions in a gas-engine on 14 cubic feet of ordinary town gas (16-candle power), and that such gas costs, delivered in our large cities, only about $1·50 per 1000 cubic feet, it becomes evident that we can pay the gas company their profit on manufacture, distribution, and collecting, and still produce electric light in our central station at a less cost than gaslight; and yet when we have distributed our energy to our customers we must charge them more than do the gas company, light for light, and then be satisfied with far less profit on an increased investment than the gas company get on their lesser investment. It seems to me that this indicates something radically wrong in a direction to which our engineers have given little attention—that is to say, in the direction of our methods of distribution.

We have constantly striven to increase our radii of distribution, and have done this until we could go no farther and give satisfactory service. We have then built additional stations; and many managers now find themselves again confronted with the same question: Is it possible for me to increase my radius, or must I decide between foregoing the increased business just beyond my reach or, taking the bull by the horns, build another station?

Unquestionably the gas engineer has the advantage of the electrical engineer in his method of distribution; but he has this advantage solely through the apathy of the electrical engineer, and not through any inherent right. The facts are, indeed, the other way, for the pressure at which the gas engineer may distribute his gas is limited to that at which the gas can be burned at its most efficient rate. No such limitation is placed upon the engineer who distributes gas for fuel purposes. Compressed air is being daily delivered through 20 miles of pipes, with a pressure at the point of delivery of approximately 100 lbs. to the square inch, and a leakage loss not to exceed 10 per cent.; and gas for fuel purposes can be delivered through the same pipes at the same pressure and leakage, whereas for illuminating purposes the final pressure is limited to a fraction of a pound in pressure to the square inch. But even under these conditions, the Consolidated Gaslight Company of New York are distributing gas from the Haarlem River down to the Battery, a clear distance of 13 miles; and The Gaslight and Coke Company of London are delivering gas over 70 miles of territory through 2000 miles of mains, to a distance of 17 miles from their station. On the same investment in pipes, therefore, a far greater gas delivery can be made for power purposes than can be made for lighting purposes; and the electrical engineer who will deliver his energy to his centres of distribution in the gaseous form will have an enormous advantage over the gas company, by reason of his ability to distribute his gas at greater pressure. But he must be careful not to throw away the advantage thus gained by distributing his electrical energy over too extended areas. It is my conviction that the tendency to increase the radius of distribution is in the wrong direction, and that our solution is in the contrary one—viz., in increasing the number of our centres and decreasing the radii.

As regards the economy of distribution of energy in the gaseous form, I gave some figures in another place,* which I ask permission to quote here. I assumed that we wished to transmit our gas to a distance of 5000 yards, or nearly three miles, through a 12-inch pipe; that this gas had a specific gravity of ·55 as compared with air; and that its calorific power was such that, when burned in a gas-engine under fair conditions, it would require 25 cubic feet to produce one brake horse-power-hour. In order to allow for bends, I assumed that there were 25 90° bends—an average of one every 200 yards. The results obtained under varying initial pressures showed that 1600-horse power could be delivered under 10 inches of water pressure, through a 12-inch pipe with 25 90° bends, to a distance of 5000 yards with an expenditure of but 0·07 per cent. of the power delivered. The Gaslight and Coke Company, in their straight-away transmission of 17 miles, which is comparable with some of our longest electrical transmissions, use an initial pressure of 30 inches. With this pressure, we could deliver through the 5000 yards of 12-inch pipe approximately 2700-horse power with an expenditure of about 0·17 per cent. of the power delivered. The cost of this pipe, which would weigh 800 tons, would, at present prices in the United States, be $16,000. If we should endeavour to deliver 2700-horse power electrically to the same distance with the same efficiency of transmission at 10,000 volts, it would require copper which would weigh 900,000 lbs., and cost, at 12c. per pound, $108,000, or 6½ times as much as the gas-mains, and require transforming down, after it was delivered, before it could be utilized. The foregoing estimates allow nothing for leakage, which in gas-mains is sometimes, though not necessarily, very large. According to Mr. J. M'Gilchrist, the loss by leakage on the 2000 miles of mains of The Gaslight and Coke Company, through which a maximum of 128 million cubic feet of gas per day is delivered, is only a fraction over 5 per cent.

The extreme cheapness of transmission of gas distribution enables the gas manufacturer to place his generating plant where real estate, coal, and water are cheap; and thus we find all the gas plants in New York City located on the water-front, whereas the principal electric light plants are erected on the most expensive land, at such a distance from the water-front that the hauling of coal and the disposal of the ashes cost one of the most favourably located of these plants 54c. per ton on an aggregate of some 50,000 tons of coal per annum. Water for condensing or other purposes costs the largest consumers in New York 10c. per 100 cubic feet; rendering it, in most cases, more economical to operate condensing than non-condensing engines.

These facts, and the further fact that the gas manufacturer utilizes the greater portion of his generating plant continuously, and at its maximum efficiency, explain why, on an investment of less than one-third the amount, he can accomplish essentially the same results more cheaply than can the electrical engineer. The gas engineer, by reason of the facility of storage of his product, has practically no stand-by losses; and his total investment is constantly worked to nearly its maximum capacity. About the only portions of the plant not so continuously employed are his distributing-mains, for these are not employed to their fullest capacity except for an hour or two each day. He has avoided these inefficiencies over a portion of his system, however, by establishing distributing gasholders at convenient centres, so that the mains connecting them and the generating plant are continually employed, and only those radiating from these centres fall short of their full earning capacity.

The electrical engineer has appreciated the effect of the variable character of his load upon the earning capacity of his plant; and some of the most progressive engineers are convinced that it is economical to supplant the extra engines and dynamos necessary to take the peak of the load with storage batteries, which cost as much as, if not more than, the apparatus displaced. But his transmission and distribution lines, which cost more than those of the gas plant, as we have seen, are still utilized to their full extent for only a very small portion of the time. To obviate this, the system of outlying storage battery centres of distribution has been suggested, and in some cases employed. This, it seems to me, is a step in the right direction. But we must go further. We must first of all materially reduce our enormous fixed charges, and next we must find some means of reducing our operating expenses, and accomplish both of these reforms without sacrifice of reliability of service.

Can we do better than take a lesson from the gas engineer, who has already, in a measure, solved these problems? I not only think we can profitably imitate him, but also that we can possibly go one better. The first step would be to move our generating plants from the expensive sites now occupied, and place them on land where water and fuel may be had most cheaply. If by this move we can save in our coal bill 50c. on every ton of coal costing (say) $2·50, we have at once made a material gain in operating expenses as well. If by adopting gaseous transmission we can cover a vastly increased area at the same cost, we have made another gain; and if by converting

* The reference is to the author's articles on "Gas *v.* Electricity for Power Transmission," noticed in the "JOURNAL" for Dec. 15, 1896.—ED. J.G.L.

our coal into gas we are enabled to utilize coal that costs $1 or $1·50 per ton, whereas before we were paying $2·50, another material gain has been accomplished. If by reason of the exceedingly cheap method of gas storage, which, when employed on a large scale, can be provided on an investment of but $1·50 per horse-power-hour capacity,* we can employ the real estate occupied, the buildings, apparatus, labour, and administrative force to their fullest capacity, we have again reduced very materially both our fixed charges and our operating expenses.

We have seen that a London Gas Company are supplying 70 square miles of territory through 2000 miles of pipes with a loss by leakage of but a fraction over 5 per cent., and that they have a straightaway transmission of 17 miles. The economical distribution of gas over areas much larger, and to distances much greater, than have ever been attempted electrically by the direct current is therefore no longer an experiment, but an accomplished fact; and this fact becomes still more impressive when we realize that, after paying all the expenses of such transmission and the gas company's profit, we can buy that gas, and produce more light from it through the intermediary of a gas-engine and dynamo, at less expense than we can buy electric light, or than we could get from the same amount of gas burned as an illuminant in the ordinary way. If these be facts, they are very impressive; and they should stimulate us to see how far we, as purveyors of electric power and light, can avail ourselves of them.

My own suggestion, expressed on several previous occasions, is this: Locate a gas-generating plant with regard to economy of land, fuel, &c., and instal at this point a large gasholder, so that every dollar of investment there would have a maximum earning capacity. Taking advantage of the greater economy of gas over electrical transmission, transmit this gas to local centres of distribution. At these points, smaller holders should be erected, so as to enable the gas-mains to be used to their maximum capacity. Gas-engines would take the place of steam-boilers and engines. Less space would be required, and stand-by losses entirely avoided. If our load-line were such as to warrant the introduction of storage batteries, these would supplant the local gas storage; and the real estate at this point, as well as the dynamos, engines, and labour, would all be employed continuously to their best advantage. In fact, every dollar of investment from the gas-generating plant to the electrical plant at the local distributing centre, including the gas-mains, would be employed to its best advantage; leaving only the electrical distributing mains to be employed under a low load factor. The economies in investment and in operating expenses thus accomplished would enable us to reduce the radii of distribution, and thus to give the same service with less investment of copper, or better service with the same investment, and to reach at a profit unsupplied territory not accessible or profitable by present methods.

I do not know exactly what proportion of the total cost of producing illuminating gas is due to the refinements of manufacture rendered necessary for the service it supplies; but it is undoubtedly large. Gas sufficiently clean for fuel purposes, without its high illuminating properties, but of nearly equal calorific power, could doubtless be manufactured for considerably less than it costs the gas companies to produce illuminating gas. The fact, too, that it could be distributed at very much higher pressures would tend still further to result in economy. As to the quality of the gas, it will pay to generate such as has a high calorific power, if it is to be transmitted for considerable distances. If it is to be generated locally and used on the spot, a low grade, such as the Dowson gas, having a calorific power of one-fourth that of ordinary 16-candle power gas, would undoubtedly be the most economical. But, by reason of the larger volume required, and of the greater frictional losses due to its higher specific gravity, such a gas would be less economical, where long transmissions were involved, than the richer and lighter gas produced at somewhat higher first cost.

Stoppages of Services by Naphthalene.—Herr A. Hoffmann, the Manager of the Kaiserlantern Gas-Works, communicated to the Mid-Rhenish Association of Gas and Water Engineers some interesting facts on naphthalene stoppages. They were found to occur freely, notwithstanding regular condensation of the gas; and to obviate them a large atmospheric condenser was then also erected. The real cause, however, was then accidentally discovered. All the appliances had been joined up to the steam-pipes for the purpose of periodically blowing them out with steam. A large steam-pipe was under repair, when a strong smell of gas was perceived; and it was found that the valve connecting the steam services to the last condenser leaked. Steam had thus been continually passing into the condenser; and though the temperature of the gas was kept down to 57° Fahr., the steam carried forward naphthalene. The steam-pipes were then disconnected from the apparatus throughout the works, and no further trouble from depositions of naphthalene was experienced.

* A 500 cubic feet holder would cost erected in New York about $700; a 1000 cubic feet holder, $900 to $1000; a 150,000 cubic feet holder, $15,000; and a 3,000,000 cubic feet holder, $180,000. Assuming that a gas-engine requires 25 cubic feet per horse-power-hour, which is exceedingly liberal for the best types of modern gas-engines using gas of the average quality of the ordinary illuminating kind, the investment per horse-power-hour capacity for the largest sized holder named would be as given—N.W.P.

A NEW MEANS OF STORING ACETYLENE.

A recent communication to the Académie des Sciences by MM. G. Claude and A. Hess, describes a means by which it is said that acetylene may be stored in small compass without risk of danger on its compression and liquefaction. We extract the following particulars from the "Comptes Rendus."

Acetylene is quite appreciably soluble in alcohol and acetic acid, and to a very great extent in acetal, methylal, and ethyl acetate. It is, however, particularly soluble in ordinary acetone, which is readily obtainable for industrial purposes. Acetone, under atmospheric pressure, and at 59° Fahr., dissolves about 25 times its volume of acetylene. The amount dissolved increases nearly in proportion to the pressure; so that under 12 atmospheres, acetone dissolves 300 times its volume of the gas. To use acetylene thus dissolved under pressure, it is only necessary to gradually open a tap on the upper part of the receptacle; and the gas is given up until the liquid only retains as much as it dissolves under ordinary pressure. The exhausted liquid may then receive another charge of the acetylene under pressure.

The volume of the acetone increases when it takes up acetylene by 0·04 for every atmosphere pressure; and therefore a solution made under a pressure of 12 atmospheres has a volume about one-and-a-half times that of the original solvent. If the corresponding volume of the gas is taken into account, the curious conclusion is reached that the density of the increment which may be taken as the volume of the acetylene is 0·70; while under similar conditions of temperature and pressure, the density of liquid acetylene is only 0·40. In other words, if acetone were added to liquid acetylene, a considerable contraction would occur. Therefore it seems possible that, under proper pressure, there may be stored in unit volume more dissolved acetylene than liquid acetylene.

The solubility of acetylene in acetone diminishes by one-half for a rise in temperature from 59° to 122° Fahr.; and therefore the pressure in a receptacle will double for a rise of about 54° Fahr. This variation is less than that of liquid acetylene, with which a pressure of 24 atmospheres increases to 70 for a rise of only 32·4° Fahr. Consequently, very stout vessels are necessary for liquid acetylene; whereas owing to the pressures of dissolved acetylene being much more narrowly restricted, comparatively thin and light vessels may be used with safety for it. Therefore, weight for weight, receptacles may contain much more dissolved than liquid acetylene. The coefficient of dilatation of dissolved acetylene varies with the pressure, but does not nearly approach that of liquid acetylene, so that the receptacles may be almost completely filled with it without fear of rupture, which is not the case with the liquefied gas.

The present state of knowledge of explosive substances justifies the conclusion that the explosive character of acetylene—due to its endothermic formation—if not entirely suppressed, is at least much weakened when it is dissolved in an inert liquid. This conclusion is supported by the evidence of an experiment, in which a platinum wire passed through a solution of acetylene in acetone under 3 atmospheres pressure was maintained at bright redness by an electric current for an indefinite time.

THE DESTRUCTION OF IRON PIPES BY THE CARBONIC ACID DISSOLVED IN WATER.

Researches by Mons. R. Petit, as described in the "Comptes Rendus," throw some light on the destructive action of certain waters on iron pipes; and they also bear upon the question of the purification of water by iron. Waters which contain little lime but an appreciable quantity of dissolved carbonic acid were observed to exercise a solvent action on iron, and the course of the action was traced. A known quantity of iron filings was placed in each of three vessels, which were respectively filled with ordinary river water, and the same water after carbonic acid had passed through it for a few minutes, and after the addition of sufficient lime to just neutralize the dissolved carbonic acid. The vessels were sealed by mercury from contact with the air; and after the lapse of a certain time, the iron dissolved in each was determined. In the first case, the water had dissolved about 0·0003 per cent., and in the second 0·02 per cent., of its weight of iron; while in the third, only traces of iron could be detected. The water in the second case was clear; but on standing exposed to the air, ferric oxide separated. It was therefore inferred that waters containing carbonic acid and very little lime dissolve iron as ferrous carbonate. The latter is then decomposed by the oxygen of the air, and ferric oxide is deposited and carbonic acid formed. The latter can again attack the iron; and thus water containing little carbonic acid may have a very powerful action on iron pipes.

The effect of certain saline solutions on iron was observed in a similar manner, both in the presence and in the absence of dissolved carbonic acid. The solutions were of about 0·1 gramme per litre, of calcium chloride, sodium chloride, potassium sulphate, and calcium nitrate. They were allowed to act on the iron filings in sealed vessels for eleven days at a room temperature of about 54° Fahr. Each salt was found to form a specific quantity of ferric oxide independently of the presence of

carbonic acid. When this was present, a quantity of iron was in addition taken into solution. In the case of potassium sulphate, the carbonic acid dissolved 14·8 per cent. of the iron filings; while about 7·6 per cent. of ferric oxide was found, whether carbonic acid was present or absent. In the absence of carbonic acid, the iron dissolved was so little that it was scarcely recognizable by the sulpho-cyanide test. Repeating these experiments with access of air, ferric oxide separated; but the iron in solution remained the same. The quantity of oxide increased with lapse of time; and with the solution of calcium chloride, as much as 36·9 per cent. of the iron taken was thus converted into oxide.

LONDON DRAINAGE AND THAMES PURIFICATION.

At a recent Meeting of the Institution of Civil Engineers, two communications on the above subjects were submitted.

In the first paper, entitled "The Main Drainage of London," the authors (Messrs. Santo Crimp and Worth, MM.Inst. C.E.) described in detail the works carried out in London for the purpose of intercepting the sewage which formerly passed directly into the river, and conveying it to outfall works at Barking and Crossness, about 14 miles below London Bridge. The works designed by the late Sir J. W. Bazalgette, and carried out by him for the Metropolitan Board of Works, comprised the construction of about 110 miles of intercepting and storm-relief sewers; the former having a final discharging capacity of about 540 million gallons per day—about 2·7 times the present dry-weather flow. There were two main pumping-stations on each side of the river, with machinery of an aggregate of 3000-horse power, capable of pumping 500 million gallons per day; and a like number of storm-water pumping-stations, capable of pumping directly into the river 150 million gallons per day. The latter are used for preventing flooding in the lower parts of the Metropolis when a heavy fall of rain occurs at or about the time of high water, when the storm outlets are closed by the tidal water. The works undertaken by the London County Council to improve the pumping machinery by compounding the steam-engines at the principal stations were also described.

The outfall works for the purification of the sewage, the dry-weather flow of which now exceeds 200 million gallons per day, were next dealt with. They consist of settling-tanks and their accessories for the chemical treatment of the sewage, and the means for removing to the German Ocean the sludge produced. The tanks at Barking contain 20 million gallons; while those at Crossness hold 31 millions. The sludge, amounting to 2,169,000 tons in 1895, is discharged into the open sea at a distance of about 50 miles from the works by a fleet of six steamers, each having a carrying capacity of 1000 tons. The experimental filters for dealing with the effluent, which are capable of effecting a purification of 78 per cent., were mentioned. The question of flood discharges from an area fully built over was referred to; and the details relating to an area of 160 acres were given. It appears that the flow has reached a rate equal to 0·4 inch per hour. The bearing of this question upon the "separate" system was next referred to; and it was stated that, so far as London is concerned, the system is impracticable. There are 920 men employed in the continuous disposal of the sewage, which amounts to 75,000 million gallons per annum; the working expenses in 1895 being £104,000, or about 5½d. per head per annum. The works now dispose of the sewage from a population of 4¼ millions. The results have been the interception from the Thames of vast quantities of filth, which formerly rendered it offensive, and the conversion of the river into a relatively pure estuary.

In the second paper, the author (Mr. W. J. Dibdin, F.I.C., F.C.S.) described first the steps that have been taken, in accordance with the scheme adopted by the late Metropolitan Board of Works, for the treatment of the London sewage at the outfalls at Barking Creek and Crossness; secondly, the effect of that work in freeing the river from the raw sewage; and, thirdly, the best method of producing still further improvement. On arrival at the northern outfall works, the sewage is screened, to remove all large particles, such as rags, &c. After receiving the proper quantity of lime, it passes the iron-water station, where the solution of iron sulphate is added. The iron salt is dissolved in a tank of water heated by a steam-coil, and the concentrated solution is sufficiently diluted, and passed into the already limed sewage. The precipitation is completed in the channels, thirteen in number, about 30 feet wide, 15 feet high, and having an average length of 1000 feet. The sludge is discharged from these to the sludge-settling channels by sweeping the deposit through culverts to the receiving chamber at the engine-house, whence it is pumped into the settling channels. On its way to these, the sludge is again passed through gratings, to collect rags, &c., which might have escaped the first gratings. The quantity of solid matter extracted by the combined action of these double sets of gratings is between 80 and 100 tons per week. A destructor furnace is built close to the filth hoist, for the calcination of the refuse. After the sludge has settled, and the top water has been drawn off by means of lowering syphons, the sludge is let into the storage-tanks under the settling channels, whence it is pumped to the ships. The water from the settled sludge is separately treated with lime and iron, after which it is allowed to settle in the precipitation channels.

At the southern outfall works at Crossness, the precipitation works are more compact. Practically the whole of the lime is in solution. The iron water is made at Crossness by the simple agitation of the crystals of iron salt with water in an ordinary mixing-mill, from which the rollers are removed; stirring-arms being substituted in their place. The effect is equally efficacious with that of the steam-coil at the northern outfall works. The mode of collecting the sludge, settling it, and loading the ships is practically identical with that at the northern outall.

The discharge of the sludge takes place in the Barrow Deep, commencing at a point 10 miles east of the Nore, about half-way between the Swin Channel and the Prince's Channel. As the sludge is discharged 10 feet under water, and is thus agitated with the sea water by the action of the twin screws, its diffusion in the water is complete—so much so, indeed, that its visible effect is quickly lost. The heavy matters soon separate by subsidence; and the animal and vegetable *débris* is rapidly consumed. Though some 10 million tons of sludge have now been deposited, the most careful examination fails to detect more than the merest trace, either in dredgings or on the sandbanks, which are now as clean as in 1888. The cost amounts to about 4¼d. per ton of sludge.

The average character of the sewage before and after treatment was set out in tables of monthly averages of daily analyses of samples taken every two hours, day and night, at each outfall during the year 1894. At Crossness, in consequence of the better solution of the lime water, there has been a reduction of 17 per cent. in the matters held in solution—a result which agrees closely with the experiments made by the author in 1887. At the northern outfall, the results are not yet so good; but this will doubtless be remedied as soon as the new liming station has been erected. Tables presenting the averages of daily analyses of the river water since 1885 were given. They showed that the degree of aëration at high water had increased from 17·4 per cent. in 1887 to 55·5 per cent. in 1894; and there has been a large reduction in the quantity of free ammonia.

Reservoir Improvements at Heywood.—For some time past, the condition of the higher reservoir at Naden has engaged the attention of the Water Committee of the Heywood Corporation. The Engineer has now drawn up a scheme for its improvement. It provides for strengthening and securing the reservoir embankment beyond all possibility of doubt by means of a strong concrete retaining wall, and also for the future enlargement of the reservoir. The Engineer's estimate of the cost of the work is £10,000, exclusive of loss or plant.

Auckland (N.Z.) Gas Company, Limited.—In the report presented by the Directors of this Company at the last annual meeting, they stated that the business had increased during the past year; the consumption of gas being 22½ per cent. more than in the preceding twelve months. Arrangements were carried out last year for giving instruction in the use of gas for cooking purposes. These were highly appreciated—the lectures being well attended; and further developments are contemplated by the Board. The receipts for gas amounted to £42,081; for residuals, to £7533—the total revenue amounting to £49,846. The expenditure being £29,441, there was a balance of £20,405. The Directors recommended the payment of a dividend for the half year of 7s. 6d. per share on the paid-up shares, and of 4s. 1½d. per share on the part-paid shares. This would leave £2861 to be added to the credit of the net revenue account. The report was adopted.

Buenos Ayres (New) Gas Company, Limited.—At the annual general meeting of this Company to be held on the 27th inst., the Directors will report an improvement in the result of the Company's operations, showing a profit of £54,511; being an increase of about 20 per cent. over that of the preceding year. To this must be added the balance of £3533 brought forward. After payment of the debenture interest (£12,000), charging against revenue the cost of sundry improvements and alterations on the works and property, and other sums, amounting in all to £7054, there remains to be dealt with a total of £38,989. From this amount, £15,000 has already been paid to the shareholders as an interim dividend; and the Directors recommend that a final dividend of 6s. per share, or £15,000, be declared and paid. This will make the dividend 6 per cent., free of income-tax for the year 1896; and after transferring £5000 to the reserve fund, there remains £3989 to be carried forward. The service of public lighting is being continued by the Company.

Monte Video Water-Works Company, Limited.—At the ordinary general meeting of this Company next Thursday, the Directors will report that the gross revenue for the past year amounted to £80,225; being an increase of £4623 as compared with the previous year. The net income was £51,356, against £45,151 in 1895. After providing for interest and other charges, setting aside £2000 as provision for possible loss on outstanding accounts, and adding £1000 to the depreciation fund, there remains an available balance of £24,680 at the credit of the profit and loss account. Out of this an interim dividend of 2½ per cent. was paid on the 1st of November; and the Directors recommend a further dividend of 2½ per cent. (making 5 per cent. for the year, free of income tax), carrying forward a balance of £4680. The services in operation show an increase of 278 as compared with the previous year, and now number 10,796. The Carrera project, full particulars of which have already been laid before the shareholders, has been reported upon by all the public bodies to whom it was referred by the Government, with the result that it has been condemned. The Junta (the Municipal Council) alone favoured it, but only by a majority of one—four to three—against the report of their own technical advisers. The project is still kept hanging over the Company, notwithstanding that the Government, nearly two years ago, in reply to the demand of the Company for a public inquiry as to the water, officially declared that there never was any question as to the water, and that therefore there was no need for an inquiry.

REGISTER OF PATENTS.

Compound Gas-Engines.—Alston, C. H. T., of Glasgow. No. 4766; March 3, 1896.

The engine constructed according to this invention comprises a high-pressure or first expansion cylinder and a low-pressure or second expansion cylinder. The former is placed parallel and behind the latter cylinder, so that a flow-port in its side, at about three-quarters outstroke of its piston, opens direct to the outer end of the low-pressure cylinder, the outer jackets of which somewhat overlap each other. The piston slides only in the front cool part, and carries a non-conducting shield. On the back end of the high-pressure cylinder are placed the inlet and high-pressure exhaust-valves. The high-pressure cylinder piston travels outward, followed by the compressed mixture from the receiver till about five-sixteenths of the stroke. The supply is then cut off; the charge ignited; and expansion follows till the flow port to the low-pressure cylinder is uncovered. Expansion continues now in both cylinders till the high-pressure piston is full out, when the low-pressure piston will be about half out. The former returns, compressing the hot charge till it again covers the flow-port and its exhaust-valve is opened. Expansion now continues in the low-pressure cylinder till the high-pressure piston uncovers the flow-port, allowing the low-pressure cylinder to exhaust through the front of the high-pressure cylinder. While the high-pressure piston is travelling outwards over the flow-port, cold air may enter the low-pressure cylinder from the receiver until the high-pressure piston again uncovers the flow-port, when the cycle is repeated as before.

The mixing of the gas and air is effected by the mouths of two pipes conveying gas and air opposing each other, and fitted with perforated caps surrounded by a perforated sleeve. The igniting device comprises three valves on one spindle; the top and bottom valves closing on their seats upwardly, the centre valve downwardly. Holes are placed in the centre valve, so that there is always free communication between the top and bottom valves in any position. The air-holes in the seat of the centre valve open to the atmosphere. Below the bottom valve is an igniting chamber; and in this is another valve, closing the mouth of the ignition-tube. Water is forced into the cylinders by a pump driven direct off the crosshead. The plunger-head is at the end farthest from the guide, having two holes through it—one to the end of the plunger, the other on the other side. Water enters the barrel in the ordinary way, and is forced through the holes in the plunger and a delivery-valve in the crosshead and a hole in the piston-rod, into the piston. It returns by a different channel—leaving the plunger at the outlet on the opposite side of the head on the plunger. Thus the pump and the telescopic connection are formed in one contrivance.

Checking the Collection of Money in Prepayment Gas-Meters.—Beechey, C. G., of Liverpool. No. 5645; March 13, 1896.

This invention has for its object the provision of means by which the checking of those charged with the collection of the money from prepayment meters, and also those who use the meters, is afforded, and fraudulent action detected.

The recording mechanism comprises a marker, and a strip of paper on which a diagram is drawn by the marker. This marker is adapted to be operated in a "postpayment" meter, twice for such record; the first mark being effected by the movement of the meter in passing gas, and the second (preferably in conjunction with the first) by the coin, as it passes through or falls on the mechanism, moving it from the part at which it is introduced into the receptacle for receiving it, and which is accessible to the gas company's agents only. The marking-device is actuated in this second action by the coin, or a part of the mechanism acting upon it, at the time of the delivery of the coin. The first marking occurs as the gas for which the coin is being delivered is consumed; the second marking takes place at the end of the consumption of the gas, and in connection with the first marking. In this way, each particular movement of the meter corresponding to each coin delivered, will be shown. When the meter has been properly worked by a coin, the second marking will be made; while when it has been improperly worked, the second marking would not be effected, and so the improper working of the meter would be shown.

When the paper is in the form of a continuous strip or ribbon, it is so arranged, or the mechanism is so devised, that a blank part of the paper at each end exists containing no diagram, except it be a straight line; so that the true diagram, or record, lies between these blank ends. In this way, each chart removed by the collector from the meter contains the whole diagram or record, corresponding with the sum collected and delivered during the taking of such record.

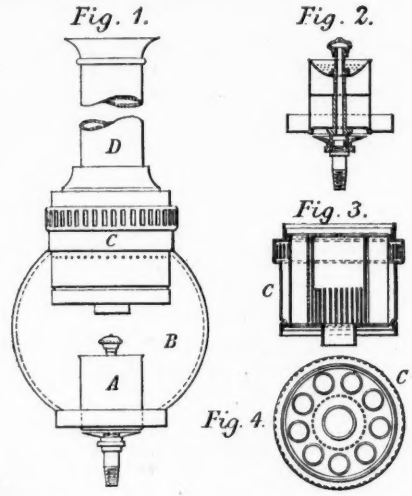
The recording mechanism is so arranged that, when the money is collected from the meter, and the diagram or record is taken corresponding with the money delivered into the coin-receiver, the inspector has, before tearing off the diagram, to pull down the tape a certain distance from off the supply-roll. This causes the commencement of the marking of the fresh diagram to take place some distance from the end; and this will happen at the other end. The means employed for recording may be also adapted to cause one of every twelve or other set of markings to be distinctly indicated in some special way, so that the chart marked will indicate the number of shillings or other higher value, while the units over these, at either end, merely have to be added.

In the case of the coins being discharged into a receptacle from a conduit, the chart-actuating mechanism is disposed in the casing with the conduit and the coin-moving mechanism, and is only accessible to the person who has access to the coin-receptacle.

Regenerative Gas-Lamps.—Bower, G., of St. Neots. No. 6055; March 18, 1896.

This lamp consists of three parts—the burner, the glass cover, and the regenerator—as illustrated. Fig. 1 is an elevation; fig. 2, a vertical section of the burner; fig 3, a vertical section of the regenerator; and fig. 4, a plan of the underside of it.

The burner A supports the glass globe or cover B, which in turn supports the regenerator C with its superposed chimney D. The burner A is formed with a cupped flange; and this, with the rim above, forms a gallery which engages with the lower rim of the glass cover and supports it. Up through the centre of the flange passes the gas-supply pipe, to the upper end of which is screwed the burner proper. This is preferably composed of a non-corrodible material, having a number of holes arranged radially in such manner that the gas can issue in a horizontal direction and form a ring of flame. At the upper end of the gas-pipe, a dished and perforated diaphragm is fixed, and to the outer edge of it is attached one end of a short cylindrical tube, the other end of which is fastened to the cupped flange, thus connecting it with the dished diaphragm, and leaving an annular space between the exterior of the gas-pipe and the tube. The cupped flange is perforated; the holes permitting free access of air to the interior of the tube, and thence through the perforations in to the underside of the flame. The air current, while passing through the holes and the perforations in the dished diaphragm, is broken up, and reaches the flame in a heated condition.



The globe B is formed with a lower rim, which fits into the rim of the burner, and has an upper rim in which fits the body of the regenerator C. It serves to protect the flame from any access of air, except that passing through the burner or through the regenerator.

The regenerator C (which is made of material not readily oxidizable) is so constructed that the greater portion of its body fits into, and depends from, the upper rim of the glass cover; its lower end projecting into it sufficiently far to bring it into proximity to the other side of the flame. It is composed of an outer cylindrical shell, bulged to form a projecting part of larger diameter than the upper rim of the globe or cover B. Thus the bulged part rests upon the rim; and the whole of the regenerator and its chimney D is supported in position by it. The bulged portion is perforated by slits, through which air passes to the annular space between the outer shell and an inner cylindrical tube, which is perforated near its lower end with slits, through which the air from the annular space passes to the nozzle and to the upper side of the flame. An upper flange and a lower flange or tube-plate connect the outer shell with the tube; and these tube-plates are perforated to receive the ends of a number of tubes, which serve to connect the tube-plates together. These tubes pass through, but do not fill, the annular space between the outer shell and the inner tube, in such manner that the air entering the slits must pass around, and in close contact with, the exterior of the heated tubes before reaching the slits on its way to the upper side of the flame. The tubes are heated by the products of combustion passing up through them to the chimney D.

The action of the lamp is as follows: The gas in its passage to the burner, and the air while passing through the interior of the outer tube, are moderately heated; and the current of air through the perforations of the dished plate has a tendency to drive the flame upwards. The chimney, however, pulls the air through the slits of the regenerator; and passing round and being heated by contact with the tubes, enters the lamp through the slits and nozzle, and tends to drive the flame downwards. Being thus suspended between two opposing currents of air, the flame is steadied; and, the air which enters through the regenerator being highly heated, the light is increased.

Indicating Statements of Account with Automatic Meters.—Doré, G., of Rhayader. No. 6233; March 20, 1896.

This invention relates to means for recording and indicating statements of account or charge for commodities supplied by meters. For instance, for recording and indicating an account in English money three dials are employed—one marked with twelve divisions, as units for pence; a second dial with twenty divisions, as units for shillings; and one dial marked with any number of divisions, for the pounds. The count-wheels for these are geared accordingly in the train of wheels; and the outer ends of the spindles of the count-wheels extend through the dials, and carry index fingers or pointers. The train of wheels is connected with any moving part of the meter mechanism proper, to which it may be attached so as to properly record a given quantity for each unit of charge. In this way, the actual amount chargeable will be clearly shown upon the indicator dials, and may be quickly read off. A strip of material enclosed in the dial-case may be mounted on rollers therein; and the account from time to time would be marked down by the collector. By means of a key, the count-wheels dial-pointers can be set to zero upon each time of taking the account.

Incandescent Gas-Lamps.—Duke, J. F., of West Dulwich. No. 7233; April 2, 1896.

The object of this invention is to obviate the shattering effects upon the mantle of incandescent gas-lamps due to explosion when the lamps are lighted—more particularly by means of a match or of an automatic igniter of the kind described in patent No. 969 of 1895, and not by a

permanently lighted gas-jet. The shattering effect is due to the use of the "lighting-back plate"—that is to say, the plate usually placed on the burner to prevent the flame which blows down when the lighting takes place from approaching the air-inlets to the atmospheric burner. This plate, by obstructing the explosion in a downward direction, causes a recoil in the chimney just where the mantle is placed, with the result that the mantle is often shattered. The inventor proposes to cover the air-inlets internally with wire gauze, and to dispense with the lighting-back plate. Consequently, while there is no obstruction to the downward effects of the explosion, the light is prevented by the gauze from passing through the air-holes.

Incandescent Gas-Burner Attachment.—Howard C., of Camberwell, S.E. No. 7955; April 15, 1896.

This invention refers to a transparent glass attachment for incandescent gas-burners, providing means for more evenly distributing the necessary updraught around the burner, and for preventing sudden winds from distorting the flame, and consequently rupturing the mantle; and this without causing a downward shadow, as in similar devices made of metal.

Prepayment Gas-Meters.—Burchard, L.S.; a communication from W. Webber, of New York. No. 8234; April 18, 1896.

This invention relates chiefly to coin-freed mechanism for gas-meters; the object being to simplify the mechanism described in patent No. 19,049 of 1895.

According to the present invention, the valve by means of which the flow of gas through the meter is controlled, is operated to lift or open it by means of a cam-surface or flange on a wheel (the "coin-counting wheel"), which is turned by the purchaser through the medium of an inserted coin in one direction a distance corresponding to the quantity of gas to be consumed and the number of coins introduced, and is turned in the reverse direction under the action of the meter. In practice, the end of the rod supporting the valve does not bear directly upon the flange, but through the intervention of a lever. When no gas is passing through the meter, the end of the lever against which the cam surface acts is off the cam surface; but, when a purchaser introduces one or more coins into the apparatus, the coin-counting wheel carrying the cam surface is moved, in order to cause it to act against the lever and open the valve—the cam surface being moved past the end of a lever a distance corresponding to the number of coins introduced. As the gas is consumed, the coin-counting wheel is moved in the reverse direction, under the action of the mechanism, until such time as the cam surface moves from beneath, or from engagement with, the lever, when the valve drops and cuts off the supply of gas. The coin-counting wheel may be rotated step by step, by means of coins introduced into a cylindrical or oscillating carrier, and adapted to engage with teeth formed on the periphery of the coin-counting wheel; the rotation of the wheel under the action of the coins serving to coil a spring, which will subsequently react to turn the wheel in the reverse direction. Or the wheel may be turned by the pressure of the gas to coil a spring.

In connection with the coin-counting wheel is an escapement, which is moved by the meter through the medium of a crank on the two-foot shaft of the meter; the crank serving to reciprocate a pawl engaging with a ratchet-wheel connected by a crank-pin with the escapement, so that for each rotation of the ratchet-wheel, the escapement makes one complete oscillation.

The number of teeth in the wheel with which the reciprocating pawl engages corresponds to the price of the gas; and as the wheel only rotates in one direction, "back lash" of the gearing, which takes place when a train of gearing is operated in one direction by the purchaser and in the other by the meter, is obviated.

Coin-Freed Mechanism for Prepayment Gas-Meters.—Tourtel, J., of Long Lane, E.C. No. 8644; April 24, 1896.

This invention relates to more simple and effective coin-freed mechanism for prepayment gas-meters than that described in patent No. 14,122 of 1891. This was a locked mechanism released by the coin on its insertion being caused to operate a lever-catch; also a coin-receiving disc or discs provided with an operating handle, a non-return ratchet-wheel, a pawl engaging with the ratchet-wheel, and a notched disc in the notch of which a spring engaged.

In the present invention, a separate non-return ratchet-wheel is dispensed with by making suitable indentations in the periphery of the coin-receiving disc; and, instead of using a separate lever-catch and pawl, both are constructed in one piece. The patentee also dispenses with the separate notched disc, and substitutes for it a projection on the face of the coin-receiving disc. In order to reduce the size of the coin-disc, he no longer supports the coin above the axis of the disc, but cuts a slot right through the disc with projections in the slot to support a coin of the required size, but so arranged as to allow a smaller coin to drop through the disc to the receptacle beneath it.

Gas-Engines.—Bickerton, H. N., of Ashton-under-Lyne. No. 8813; April 27, 1896.

This invention in gas and oil engines consists in the combination of an enclosing casting, capable of enshrouding the principal moving parts, with an oil-well, in which the moving crank can dip for automatic lubrication, and also with pendulous rings for lubricating the crank-shaft, which shaft is carried by bearings projecting within the enclosing casting, together with the automatic valves.

Gas and Oil Engines.—Drake, J. A., of Bayswater, W., and Drake, W., of Clapham Park, S.W. No. 12,633; June 9, 1896.

This invention relates, firstly, to the exhaust and air valves of motive power engines operated by the explosion or combustion of mixtures of gas or hydrocarbon oil vapour with atmospheric air; and, secondly, to means for preventing or reducing the noise made by the exhaust in such engines, consisting of an exhaust-box connected with the exhaust-pipe of the engine, and provided with a partition having an opening fitted with a tapering disc piston or valve, held normally in position by springs, so that its smaller diameter is in the hole in the partition, and the products of combustion are free to escape through the annular opening and into the atmosphere. But, whenever the exhaust from the engine enters the exhaust-box, the disc, piston, or valve is forced forward, so that its larger diameter enters the hole and practically closes it—causing the products of combustion to be retained for the moment in one side of the box, where they expand without making a noise. The disc, piston, or valve is then forced backwards automatically by its springs, so as to bring its smaller diameter into the hole, and leaving an annular space through which the exhaust gases can flow quietly to the other side of the partition and into the atmosphere.

Prepayment Gas-Meters—Harrison, S., of Pendleton, Dickinson, G. W., of Lower Broughton, Salford, and Sheard, J. T., of Sheffield. No. 13,421; June 18, 1896.

This coin-operating meter is shown in the engravings—fig. 1 being a sectional elevation, fig. 2 a sectional plan, and figs. 3 and 4 sectional end views of the index and gear case of a wet gas-meter.

The patentees employ a screw or spiral A, formed on a horizontal shaft B free to revolve in bearings when actuated by a crown or face wheel C, which is fixed to one end of the shaft, and gears with a pinion D connected to the counting mechanism. Surrounding the spiral A, but unconnected with it, is a barrel or hollow shaft E, in which, for a certain portion of its length, a narrow slot is cut. A screwed nut or collar F rides freely on A within the shaft E, and carries a pointer projecting through a slot. The revolution of A causes the nut, with its pointer, to travel in a horizontal direction along the slot; while if the shaft E be revolved and the spiral A at rest, the nut with its pointer revolves with it round the spiral, and at the same time progresses in a horizontal direction along the slot. The two movements are, in practice, made reciprocal—the revolution of the screw or spiral, which is brought about by the working of the meter as gas passes through it, causing the nut and pointer to move in one direction, and the revolution of the barrel or hollow shaft (produced by the insertion of a coin) causing them to move in the opposite direction. The pointer indicates upon a scale G the value of the gas prepaid which remains unconsumed.

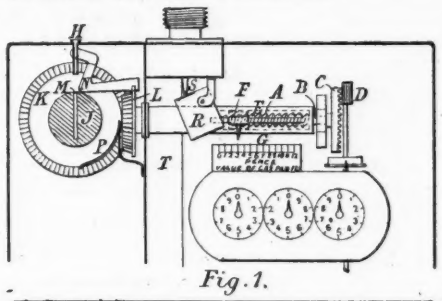


Fig. 1.

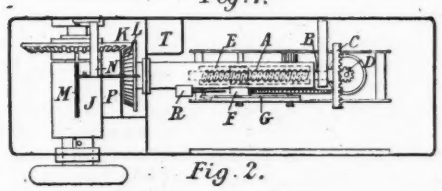


Fig. 2.

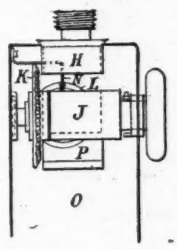


Fig. 3.

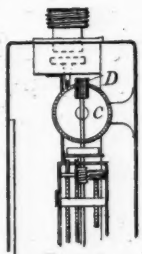


Fig. 4

The coin-receiving device is arranged as follows: Beneath a slot or shoot H in the outer case of the meter, is a drum J on a shaft, which is continued through the outer case, and which, by means of a handle on the outside and suitable stops, can be turned half a revolution. In the same axial line as the drum, but quite separate from it, is a bevel wheel K, which gears with another bevel wheel L, having only half the number of teeth, and which is fixed to the end of a shaft forming a continuation of the barrel or hollow shaft E. When a coin is dropped into the meter, it falls into a channel M prepared for it in J, and projects into a corresponding slot cut in the face of the bevel-wheel K. This connects the drum and bevel wheel together, so that the movement of the former effects a corresponding revolution of the bevel gearing—the pressure of the coin first releasing a catch N, which locks the bevel gearing from the time of one coin being passed until another is inserted. The handle, and with it the bevel wheel K, having been turned half a revolution, the bevel wheel L (and with it the barrel or hollow shaft E) has necessarily made a complete revolution, and the pointer moved one division on the scale G. The coin then drops into the box O; a guide or shield P preventing it dropping out of the slots until the wheel K has been turned half a revolution. The meter is now free to deliver gas of the value of the coin inserted, or, before the gas is consumed, other coins may be inserted *seriatim* until the full quantity of gas has been prepaid for which the apparatus is adjusted—this being determined by the length of the slot in the barrel E. When, by the insertion of the full number of coins, the nut F with its pointer is carried to the far end of the slot, it becomes impossible to move the bevel gearing K and L, and consequently to pass any more coins into the meter. If now gas be consumed through the meter,

the revolution of A taking place in unison with the counting mechanism of the meter, moves the nut and pointer back along the slot and scale until (supposing no more coins be inserted) nearly the whole of the gas prepaid has been consumed, when, as the nut approaches the near end of the slot, it comes in contact with a lever R actuating a valve S, which controls the admission of gas to the meter, and gradually closes it. By this means, the passage of gas through the meter is effectually prevented until the insertion of another coin releases the valve by causing the nut to move away from the lever. T is a channel, through which the gas, having passed through the valve S, is conducted into the interior of the meter.

The quantity of gas which will be delivered by the meter for each coin inserted can be varied by altering the size of the crown or face wheel C relative to the pinion D. Thus if the pinion has ten teeth, and one revolution of it represents the passage of 5 cubic feet of gas, a crown or face wheel of forty teeth will allow 20 cubic feet of gas to pass through the meter for each and every coin or token inserted; while a wheel of fifty teeth will allow 25 cubic feet, one of sixty teeth 30 cubic feet, and so on.

Acetylene Generator.—Whalley, D., and Hacking, J., of Blackburn. No. 15,654; July 15, 1896.

This is one of the "compressing gas cylinder" type of apparatus. Inside the generator is a gauze or perforated zinc or other metal holder, resting on brackets or supports some distance from the bottom. The calcium carbide is placed in this perforated holder, which is then put inside the generator, and the cap or cover fixed in position. The valve from the water-tank is then opened, the water thereupon flows into the generator, and as soon as the gas is generated, it passes off to the holder, or to the burner.

APPLICATIONS FOR LETTERS PATENT.

7991.—Stephenson, A. A., "Composition and apparatus for enriching gas." March 29.
8007.—Dixon, R., "Manufacture of coke." March 29.
8030.—Meinecke, H. & P., "Disc water-meters." March 29.
8031.—Cooper, C. F., "Preventing chimney glasses from cracking when in use." March 29.
8056.—Pütsch, A., "Gas engines." March 29.
8061.—Fiddes, W., "Apparatus for cleansing gas service-pipes and fittings." March 29.
8083.—Schimmel, H., and Breslauer, E., "Ignition devices for gas-burners" March 29.
8100.—Shann, M. H. C., "Internal explosion engines." March 29.
8108.—Kitchen, J. G. A., "Acetylene generators." March 30.
8186.—Rothgiesser, G., "Gas compressing and pressure regulating apparatus, suitable for incandescent gas lighting." March 30.
8220.—Bourgois, S., Lencauchez, A., Hoche, L., and Isidor, E., "Recovery of ammonia and other products from gases." March 30.
8234.—Lowe, T. S. C., and Haug, J., "Coke, gas, and metallurgical furnaces." March 30.
8253-4.—Bromhead, S. S., "Prepayment gas-meters." Communications from F. E. Morgan. March 31.
8266.—Thorn, F. S., and Hoddle, C., "Safety-valve for use with acetylene gas generators." March 31.
8270.—Kitchen, J. G. A., "Acetylene generators." March 31.
8279.—Bushell, A. M., "An improved atmospheric gas burning false bottom." March 31.
8359.—Kemp, C. W., "Incandescent gas lighting." April 1.
8363.—Perrins, W. C., "Improvements in gas lighting." April 1.
8385.—Lecomte, A., and Loeser, I., "Improvements in bunsen burners." April 1.
8404.—Kruyswyk, J., "Governing gas-engines." April 1.
8405.—Pringle, R., "Gas-stoves for cooking and other purposes." April 1.
8415.—Valon, W. A. M'I., "Machinery for breaking coke." April 1.
8467.—New, A. G., "Valve or gas-engines." April 2.
8483.—Schlickeysen, C., "Chain bucket elevators." April 2.
8485.—Bouchaud-Praceiq, E., "Carburetting air." April 2.
8513.—Bellon-Lencauchez, J. A., called Lencauchez, "Production and purification of gas." April 2.
8551.—Exley, J. H., "Manufacturing acetylene gas." April 3.
8552.—Cousin, H., "Manufacturing acetylene." April 3.
8721.—Menne, V., "Acetylene gas generator." April 6.
8755.—Graetz, M., "Burners for the production of non-luminous flames." April 6.
8759.—Meyer, D., "Incandescent gas-burners." April 6.
8793.—Barltrop, W. P., "Production of acetylene gas." April 6.
8822.—Wimshurst, H. J., "Gas or oil engines." April 7.
8836.—Tweedie, R. O., and Morris, D., "Fittings for incandescent gas-burners." April 7.
8919.—Duncan, D. J. R., "Jointing mains, pipes, and other conduits for water, gas, and other fluids and vapours." April 7.
8939.—Southall, J., "Gas and oil engines." April 8.
8989.—Kerr, J. G., and Fry, C., "Production and storage of acetylene gas." April 8.
9041.—Cowan, W. & B., Limited, "Photometer for automatically measuring and registering the intensity of the light of a gas-flame." A communication from C. V. L. Martenson. April 9.
9045.—Rusling, C. O., "Protecting and sustaining the mantles of incandescent gas-lights." April 9.
9098.—Schütz, C., and Heydemeyer, H., "Starting gas-engines." April 9.
9174.—Lacroix, P., and Dabasse, L., "Gas-motors." April 10.
9175.—Wilkins, F., "Apparatus for impregnating atmospheric air with pure volatile hydrocarbon in substitution of gas, for producing light, heat, or power." April 10.
9192.—Wilkinson, J., and Mason, R. S., "Deodorizing the exhaust gases from gas and other motors." April 10.
9212.—Graham, M., "Charging gas-retorts." April 10.
9214.—Hopkinson, J., and Hopkinson, J., and Co., Limited, "Valves for regulating or controlling the flow of fluids." April 10.
9218.—Morris, J. G., "Incandescent gas-burners." April 10.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

The following further progress has been made with Bills, down to the adjournment of the House for the Easter recess, on Monday last week:—

Bills read a second time and committed: Lowestoft Corporation Bill, Lowestoft Water and Gas Bill, Malvern Link Urban District Gas Bill, Newport Corporation Bill.

A petition has been presented against the Lowestoft Water and Gas Bill by the Corporation of Lowestoft; and one against the Malvern Link Urban District Gas Bill, by the Malvern Urban District Council.

On Monday last week, Mr. G. Whiteley asked the President of the Local Government Board whether the sanction of the Board to certain borrowing powers applied for by the Corporation of Stockport for water-gas purposes had been refused on the ground of the occurrence of a case of water-gas poisoning there; and whether any such case had occurred and been brought to his knowledge. Mr. Chaplin replied that the sanction of the Board had not been withheld on the ground stated in the question; and no such case in the borough had been brought under his notice. So far as he was aware, water gas had not yet been supplied by the Corporation.*

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Monday, April 12.

(*Before Baron* Pollock *and a Special Jury.*)

Fox v. Jerome—The Water-Gas Libel Case.

On the proceedings in this case (see *ante*, pp. 783, 839) being resumed this morning,

Mr. *Joseph Tordoff* was called. He stated that he was now the Works Manager to Sir James Kitson at Leeds. He was formerly in the employ of the Leeds Forge Company as Works Manager from 1876. He had had practical experience of water gas for welding and illuminating; and for both purposes he thought it was successful. For welding, it was the best article which could be used; and it saved labour and time. It was not true that pressure was put on him to join the little Syndicate formed to bring out the Water-Gas Companies; nor was it accurate to say that he was pressed to take shares in lieu of cash for the money he had put into it. He did it of his own free will.

Cross-examined: He had nothing to do with the cost of production of water gas at the Leeds Forge. He did not know until he got the certificate of transfer that the shares transferred to him for the money he had put in the little Syndicate were vendor's shares.

Re-examined: Mr. Wildey, the Engineer of the Leeds Forge Company in 1888, told him that water gas was much cheaper than the coal gas of the Leeds Corporation.

Mr. *J. F. Watson*, Inspector to Sir Douglas Fox, stated that the results of the experiments he made for the purposes of the report of Sir Douglas Fox were accurate.

Cross-examined: The Leeds Forge employees charged the furnaces; but he saw every ounce of the coke weighed that was put in. He limited his experiments to the production of the gas. Meters were not attached to the generators; but the gas could be measured by the rise and fall of the holder.

Re-examined: He told the men what to do, and checked everything.

Herr *Heinrich Gerdes*, the Chief Engineer of Messrs. Pintsch's works at Fürstenwalde, said that this firm employed 2000 men in making torpedoes, dynamos, electrical incandescent lamps, and other things. He was perfectly well acquainted with the manufacture of water gas. The first installation at Fürstenwalde was erected in 1885; and the plant had since then been increased eight or nine times. They employed it for brazing, welding, and lighting with the Fahnehjelm comb. In 1889, the generator they used was practically the same as at the Leeds Forge; and he found it successful.

Cross-examined: Water gas was used in 1891 for lighting the railway station at Koenigzelt; but he could not say, of his own knowledge, that it had been introduced at any other railway station in Germany since. The price of coal gas at places where water gas was used was about 5s. per 1000 cubic feet.

Re-examined: The price of coke was 28 marks per ton; and water gas cost about 15½d. per 1000 cubic feet.

Herr *Johannes Gottlob* said he had been employed by Schultz, Knaudt, and Co., of Essen, since 1881. In the following year, he and Mr. Blass made improvements in water-gas generators; and the water-cooled ring, valve, and slide were brought out in 1884. The production of water gas at his works was 500 cubic metres per generator per hour. They had two generators at work. In 1883, water gas was used at Essen with the Fahnehjelm comb, and it was employed now; but the chief purpose to which it was put was for welding. Corrugated flues were made by them under the Fox patent; and they turned out a very large quantity every year. Water gas effected a great saving at Essen; and they now did about five times as much welding as they did prior to its introduction. Water gas permitted welding to be more economically and effectively done than coal gas.

Cross-examined: There had been an alteration in the Fahnehjelm comb, but not in its substance. The cost of water gas in 1889 was about 6d. per 1000 cubic feet. Mr. Knaudt put it at 1s. per 1000 cubic feet; and perhaps he knew better than witness.

Re-examined: With the price of fuel at 10s. per ton, the cost of water gas would be 6d. per 1000 cubic feet.

Mr. *Ernest Gearing*, the General Manager and Secretary of the Leeds Forge Company, stated that he was formerly connected with Messrs.

* Mr. Chaplin was under an erroneous impression, as water gas has been distributed, though not in the full proportion at one time contemplated by the Corporation.—Ed. J. G. L.

Thomson and Sons, shipbuilders, of Clydebank. While he was with that eminent firm, seven vessels were turned out for Her Majesty's navy, and thirty-five ships were built for the mercantile marine—including the "City of New York" and the "City of Paris." With but two exceptions, the boilers of these ships were fitted with the Fox corrugated flue. Fox's invention showed how a plain tube that had been welded could be corrugated. The invention was a very important one; and over 60,000 of the flues had been turned out by the Leeds Forge, 5000 of which had gone into the British navy. Since 1889, 15,743 tons of flues had been made by the new Company; and 10,235 tons of steel frames had been manufactured during the same period, under Fox's pressed steel frame patent. Since he became connected with the Leeds Forge, water gas had been continuously used. The water-cooled ring in the generator was an absolute necessity; and the grooved parts and water-cooled valve were very successful. He had read the specifications which had been relied on as anticipations; but he came to the conclusion that they did not anticipate the patents. At the Leeds Forge, they produced from 6,000,000 to 6,800,000 cubic feet of water gas per month. Water gas was undoubtedly a success at Essen, which place he had visited on four occasions. The Farnley Iron Company made a spirally corrugated flue; but this did not have the same strength as the Fox flue. Messrs. John Brown and Co., of Sheffield, made ribbed flues. The Leeds Forge had no real competitors in the manufacture of corrugated flues.

Cross-examined: Messrs. John Brown and Co. now made a flue with an arched surface between the ribs; but they only commenced doing so last year. There had not been a great fall in the price of corrugated flues since he became Manager of the Leeds Forge.

The further hearing of the case was adjourned until the 29th inst.

Wednesday, April 14.

(*Before Mr. Justice* LAWRANCE.)

South Staffordshire Water-Works Company v. Barrow.

Judgment was given this morning in the above-named case, the arguments in which were fully reported in the "JOURNAL" last week (p. 843). The point in dispute was the basis on which the water-rate should be levied.

Justice LAWRANCE, after stating the facts, and referring to the sections of the Acts of Parliament, said the question seemed to him to depend entirely on sections 24 and 30 of the Act of 1866. The one side maintained that this Act extended the rights given to the Burton-on-Trent Company, by their Act of 1861, to charge on the rack-rent to the districts added to their limits by the Act of 1866. The defendant, on the other hand, contended that if there was any ambiguity in the Act, it ought to be construed in favour of the public. Giving the matter the best consideration he could, in his judgment the Act of 1866 did not confer upon the Company the right to apply the higher scale given by the Act of 1861 to the extended limits added by the Act of 1866; but only the scale authorized by the Act of 1853. His judgment must therefore be for the defendant, with costs. Of course, he should give leave to appeal, as there was no doubt the case was a most difficult one.

On the application of Mr. A. T. LAWRENCE, his Lordship stayed execution on the usual terms.

The Assessment of the Cardiff Gas-Works.

At the Easter Quarter Sessions for the borough of Cardiff yesterday week, it was mentioned that the Cardiff Gas Company had four appeals against their assessment on the list. But Counsel for the appellants (Mr. Boyle) said he was not in a position to proceed with them then, and asked the Recorder that they be respited to next sessions. A little argument on the subject ensued between Mr. Boyle and Mr. Marshall (for the respondents), in the course of which the former stated that negotiations were in progress with a view to a settlement; but Mr. Marshall asserted that he was not aware that this was so. It was also stated that part of the assessment appealed against was in the county of Glamorgan. The Recorder granted a respite till next sessions; it being understood that, if the cases would be very long and that the county appeal was not heard before that time, he might fix some other date. The valuations appealed against by the Gas Company are: St. Mary's, gross, £9500; net, £4750. St. John's, gross, £3319; net, £2655. Roath, gross, £1889; net, £1511. Canton, gross, £14,270; net, £7135—totals, gross, £28,978; net, £16,051. The late valuations were: St. Mary's, gross, £3920; net, £3267. St. John's, gross, £2348; net, £1957. Roath, gross, £917; net, £764. Canton, gross, £4465; net, £3721—totals, gross, £11,650; net, £9709.

Embezzlement by a Gas Collector.

At the Westminster Police Court on Monday last week, Charles Hammond Croxford, of Cheyne Walk, Chelsea, lately a rate collector in the Fulham district for The Gaslight and Coke Company, was placed in the dock charged with the embezzlement from his employers of about £70. Mr. C. D. Humphreys prosecuted for the Company, in whose service the prisoner had been since 1895. He absconded, it was said, last December, when inquiries were being made in consequence of irregularities which had come to light. Mr. Humphreys said the Company pressed for the case to go for trial, and then they could indict the prisoner for falsification of accounts as well as for embezzlement. His methods of defalcations and complication of documents had occasioned the prosecutors great trouble. A staff of from twelve to twenty special collectors had been necessary to unravel the accounts. Mr. Marsham bound over the witnesses to give evidence against the prisoner at the sessions. The prisoner begged the Magistrate to settle the case on his plea of "Guilty." He said he had been led away. The Magistrate, however, refused the application.

A Charge of Stealing from a Prepayment Meter Dismissed.

At the recent Quarter Sessions at Hanley, Thomas Whitehouse, William Stayner, J. W. Cooper, and John Moore surrendered to their bail to answer an indictment charging them with the theft, on Feb. 17 last, of 3s. 7d., the moneys of the British Gaslight Company. It appeared that, on the date in question, the prisoners were in the Greyhound beerhouse, which is kept by Jesse Mountford. A slot gas-meter was under one of the seats in the vaults; and, in the presence of the prisoners, Mrs. Mountford had several times put money in the meter. While she was absent in the cellar she on two or three occasions heard a sound of knocking in the vaults. On each occasion she went up; and, according to her evidence, found the prisoners there alone—one of them each time, in reply to her inquiry, telling her that "it was all right." The meter was subsequently found to have been broken open; and the amount named extracted, while some coppers which the prosecution alleged Mrs. Mountford had put in since she heard the knocking were on the floor—the drawer of the meter being removed. Mr. Stokes, for the defence, submitted that at the most it was only a case of suspicion. The Deputy Recorder (Mr. J. R. V. Marchant), in summing up, pointed out that the evidence was entirely circumstantial. The jury gave the prisoners the benefit of the doubt; and they were discharged. In regard to this case, the Grand Jury made a presentment to the effect that they considered the place in which the meter was put was not very suitable for the purpose. It was likely to tempt the class of people who frequented the house.

The Registration of Water-Meters.

An important point has been raised on appeal before Judge Adams, at the Limerick Quarter Sessions, with respect to the payment for water measured by meter. The 68th section of the Public Health (Ireland) Act provides that an agreement between a local authority and a consumer may arrange for a supply by meter; and in accordance therewith, the Limerick Corporation supplied the Limerick Distillery. For the quarter ending March 24, 1896, the meter registered a consumption of 120,000 gallons; and the Corporation claimed £8 5s. 10d. in payment. The Distillery Company refused to pay on the ground that the meter was inaccurate; the consumption in previous March quarters being somewhere about 17,000 gallons. The Corporation had the meter tested; and, it being found correct, they sued before the Magistrates, who, however, gave a decree for only £4 7s. 5d. The Corporation appealed; and Mr. Fitzgibbon, who appeared for the Distillery Company, referred the Judge to the 69th section of the Act, which provided that the registration was *primâ facie* evidence of the consumption; but that, when there was a dispute as to the quantity, either party could appeal to a Court of Summary Jurisdiction, whose decision would be "final and binding." He submitted there was no right of appeal. The Court ruled with Mr. Fitzgibbon, and dismissed the appeal, with £2 costs.

Winding Up of the Reigate Water Company.—A meeting has been held for the winding up of the Reigate Water Company, the undertaking having been acquired by the East Surrey Water Company, under their Act of last year. Mr. Alderman Bidgen, J.P., presided, and stated that the original shares, which were worth £100 before the transfer took place, were now worth £240, which he thought must be satisfactory to all the shareholders. The winding-up proceedings were then concluded; and the Reigate Company ceased to exist.

Cost of the Plymouth Water-Works.—At the last meeting of the Plymouth Town Council, the Water Engineer (Mr. E. Sandeman) presented a report on the expenditure connected with the new reservoir and other works which the Corporation are carrying out. The parliamentary estimate for the reservoir and certain other contingent works was £104,310; but after the estimate was made, the Council decided to raise the reservoir embankment 3 feet, necessitating an addition of £3750, and making a total cost up to £108,060. Down to Nov. 14, 1895, when the work of building was commenced, the net expenditure on reservoir works was £29,309. According to the priced quantities submitted with the report, the sum needed to complete the Burrator dam, screen, chamber, weir, &c., would be £65,053; and the amount necessary to complete the Sheepstor dam, £16,323—together, £81,370. This amount added to the sum already expended makes a total of £110,685, or £2625 in excess of the estimates. There is, however, a sum of £2388, representing the amount allowed for contingencies in connection with the laying of the 25-inch pipe-line from Burrator to the Hartley reservoir, which is available for transference to the reservoir account, since the pipe-line was carried out within the estimate. The Council adopted the report without comment, and also approved a recommendation of the Water Committee that Mr. Sandeman should be paid 100 guineas for preparing it.

The Public Lighting of Canterbury.—The public lighting question again bulked largely in the proceedings of the Canterbury Town Council last Wednesday week. A report coming from the Committee of the whole House recommended that the decision of the Council not to be represented by Counsel at the Local Government Board inquiry should be rescinded. It also stated that a letter had been received from the Gas Company in regard to incandescent gas lighting; but the Committee advised that before the communication was considered and any contract entered into, the Company be requested to place six lamps, to consume 3 cubic feet per hour, and six lamps to consume 3½ cubic feet, as an experiment at places to be indicated by the Lighting Committee. The Mayor (Mr. G. Collard) urged the Council to come to a decision on the electric lighting question, or they might lose their Provisional Order. In the course of the discussion, it was stated that more than 25 per cent. of the ratepayers had signed against the introduction of the light; and it was asserted that the streets of Canterbury were not of a character suited to the efficient use of the electric light. It was also mentioned that the Electrical Engineer had placed the initial expenses of an installation at £23,000; and Alderman Hart was convinced that, in the end, no less than £30,000 or £40,000 would have to come out of the ratepayers' pockets in order to provide the light for a few. The old question as to members who were shareholders in the Gas Company voting was raised; but Alderman Hart declared his intention of doing so, notwithstanding the opinion of the Town Clerk that "he did not think it would be equitable for shareholders to vote." The result was that the minutes were confirmed with the exception of the part referring to the representation by Counsel at the inquiry.

MISCELLANEOUS NEWS.

THE POSITION OF SULPHATE OF AMMONIA.

An Important Project.

The following circular, offering some important suggestions on the above subject, was issued last Saturday :—

The long-continued depression of sulphate of ammonia and its low market value compared with that of nitrate of soda, have much exercised manufacturers ; and it is generally felt that some steps should be taken to remedy this state of affairs. With this end in view, an informal conference of a Committee, representing the Sulphate of Ammonia Association and several of the largest outside makers, has taken place. The meeting was an influential one, as is shown by the fact that the gentlemen present represented a production of over 100,000 tons out of a total of 180,000 tons, the estimated annual make of the United Kingdom. The position and prospects of sulphate of ammonia were fully considered, and it was agreed that, admirable as the efforts and work of the Sulphate of Ammonia Association have been, and admitting the great benefit which the trade has derived from the liberal distribution of statistics and literature on the subject of sulphate of ammonia and its uses, a more systematic and combined action on the part of those interested is needed to restore the article to its proper position in the chemical manure market.

The Sulphate of Ammonia Association has never had sufficient funds at its disposal to enable it to do more than collect and publish statistics, &c. ; and the Conference recommends that all sulphate of ammonia makers be requested to subscribe annually a sum not exceeding 6d. per ton on their yearly production, and that the fund thus raised be disposed of by a Committee elected by the contributors themselves, in such a manner as they may from time to time decide; the intention being to follow on somewhat similar lines to those adopted by the permanent Nitrate Committee, whose action has benefited the nitrate of soda market in a very remarkable degree.

The following suggestions were made :—

1.—To offer prizes to all agricultural societies in the United Kingdom.
2.—To employ properly qualified travellers and experts to attend markets, agricultural shows, meetings of agricultural societies, chambers of commerce, &c.
3.—To employ eminent chemists and agriculturists to conduct special experiments to demonstrate the merits of sulphate of ammonia compared with nitrate of soda, and to bring the results of such investigation to the notice of farmers and others.

If you think well of the scheme, we shall be glad to hear that you will join it; and we may add that it will not be proceeded with unless a majority in the trade support it.

(Signed) W. G. Blagden (The Gaslight and Coke Company).
F. Livesey (South Metropolitan Gas Company).
Robert Orr (for James Miller, Son, and Co., and the Scottish Mineral Oil Association).
Forbes, Abbott, and Lennard (for themselves and the Standard Ammonia Company).
Brotherton and Co.
The Sulphate of Ammonia Association.
Hardman and Holden.
R. & J. Dempster.
Sadler and Co.

Replies to the circular are to be addressed to Colonel Sadler, Mayor of Middlesbrough.

THE LONDON COUNTY COUNCIL AND CARBIDE OF CALCIUM.

The Chief Officer of the Public Control Department of the London County Council (Mr. A. Spencer) has prepared a set of regulations in regard to the keeping, sale, and conveyance of carbide of calcium in the Metropolis. He points out that they have no legal validity, but are intended only for the information and guidance of persons concerned, who are referred to the Petroleum Acts and to the Order in Council on this matter, dated Feb. 26. This was given in the "Journal" on the 9th ult. (p. 552) ; an important correction by the Home Office being noticed in the following issue.

According to the Order above referred to, carbide of calcium can only be kept in pursuance of a licence granted by a local authority. No exemptions from this provision are made ; so that a licence is necessary for the keeping of any quantity of the carbide, whether for sale or private use. Where carbide is kept at any place or sold or exposed for sale, the vessel containing it is to bear a label having upon it, in conspicuous characters, the words "Carbide of Calcium," "Dangerous if not Kept Dry," together with the following caution : "The contents of this package are liable, if brought into contact with moisture, to give off a highly inflammable gas," and also the name and address of the owner or vendor. Application to the Council for a licence to keep carbide of calcium at any place in the County of London, except the City, must be made upon a form provided for the purpose, which can be obtained by application in writing to the Chief Officer of the Public Control Department of the London County Council, 21, Whitehall Place, S.W., accompanied by a fee of 5s., which will be returned if the licence is not granted. Every application must specify the quantity of carbide the applicant desires to keep, and the proposed place and method of storage ; and he must state if it is only to be kept for sale in closed vessels, or to be used in the manufacture of acetylene gas. Carbide of calcium should be kept in strong metal vessels, which should be so constructed and closed as to prevent the admission of water or atmospheric moisture. They should only be opened for the time necessary for the removal of any required quantity of carbide, or for the refilling of the vessels. No vessel should have a greater capacity than is necessary for containing 112 lbs. of carbide. Every vessel of a greater capacity than 2 lbs. should be provided with a lock, or be placed in a locked receptacle, so as to prevent unauthorized persons gaining access to the contents. Copper should not be used in the construction of vessels for containing carbide. Vessels containing carbide should not be kept in dwelling-houses, but in dry and well-ventilated outbuildings. Small quantities for sale or immediate use will be allowed in shops, dwellings, or workshops, if the arrangements are satisfactory. The Council propose only to grant licences to keep carbide which is pure in a commercial sense—*i.e.*, which contains no impurities liable to generate phosphoretted or siliciuretted hydrogen, so as to render the gas evolved liable to ignite spontaneously.

Where carbide of calcium is kept for the manufacture of acetylene gas, Mr. Spencer says it is desirable that such of the following precautions for ensuring safety as are applicable to the circumstances should be adopted : (1) Every apparatus for generating and storing acetylene gas should be placed in an outbuilding. (This does not apply to portable apparatus holding a charge of less than 2 lbs. of carbide.) (2) Such building should be separated as far as may be practicable from inhabited buildings, and should be well ventilated. (3) No fire or such artificial light as would ignite inflammable gas should be taken into or near the building or place where a gas-making apparatus is situated. Every apparatus (including the generator and holder) used for acetylene gas should, as far as practicable, be constructed and used so as to provide against the special risk—*i.e.* : Copper should not be used in any part of the apparatus; the various parts should be of adequate strength ; escape of gas from the apparatus should be carefully guarded against ; satisfactory provision should be made against dangerous development of heat and undue pressure, by the employment of an adequate safety-valve connected with a pipe discharging into the open air, and a suitable pressure-gauge should be attached to the apparatus ; provision should be made for the residue of the carbide being mixed with at least ten times its bulk of water on being removed from the apparatus ; and no person should have charge of apparatus until he has been properly instructed in its management.

Licences are granted for keeping carbide of calcium for periods not exceeding one year ; and prior to expiration, application must be made for their renewal. Notice of the expiration, and a form of application for renewal, is sent to each licensee at the proper time.

Where carbide of calcium is sent or conveyed, the vessel containing it shall bear a label similar to the one above referred to, and also the name and address of the sender. The conveyance of carbide to or from licensed premises must be in accordance with the conditions of the licence.

Any dealer who refuses to show to any officer authorized by the Council every or any place, or all or any of the vessels, in which carbide of calcium in his possession is kept, or to give him such assistance as he may require for examining the same, or to give to such officer samples of the carbide on payment of their value, or who wilfully obstructs the Council, or any officer, in the execution of the above-named acts and Order, will be liable to a penalty not exceeding £20.

GAS AND ELECTRIC LIGHTING IN MASSACHUSETTS.

According to the twelfth annual report of the Massachusetts Board of Gas and Electric Light Commissioners, a copy of which has been forwarded to us by the Chairman (Mr. Forrest E. Barker), there were at the commencement of the present year 133 companies, 12 towns, and 1 city under the supervision of the Board. Of the former, 47 are engaged solely in the supply of gas, 24 in the supply of both gas and the electric light, and 62 provide the latter illuminant only. Of the towns, two have plants for gas and electric light ; the others furnish the latter only. During the past year, five companies were chartered with gas or electric lighting powers ; the total capital amounting to $187,000. Water gas, either alone or in combination with coal gas, is distributed in 26 towns. The accounts of the companies are made up to June 30 each year. The total receipts of the gas undertakings in the twelve months ending at that date last year amounted to $6,043,652, as compared with $5,280,887 in 1894-5. The sale of gas by meter produced $5,517,061, against $4,779,821 in the preceding year. The expenditure came to $4,219,254, as compared with $3,770,151 before. There was therefore an apparent net profit of $1,824,398 on the gas business ; but this sum was made up to $2,223,977 by amounts received for interest, rents, and profit from the supply of electric current. After payment of the interest on bonds and loans, dividends, &c., amounting to $1,865,779, there was a surplus on the year's working of $358,198, as against a deficit of $286,949 in 1894-5. The receipts for gas sold by meter show an increase of $737,240, as compared with $279,216 before. The former figures are the largest for any year since the returns have been made. Though the quantity of gas sold for public lighting increased, the income from this source dropped to the extent of $6367 ; showing an appreciable reduction in the average price charged. The total amount of dividend declared was $1,068,649. Three of the companies did not cover their expenses ; and 22 did not earn sufficient to warrant the declaration of any dividend. The maximum return was 12 per cent. ; the minimum, 1½ per cent.—the average of the 51 paying companies being 6¾ per cent. The value of the gas plants, as found by local assessors, is given in round numbers as $17,500,000 ; and the amount paid for taxes, including State supervision, after appropriating to electric account that part of the gas companies' taxes belonging to their electrical departments, was $291,653—an average of 5·4c. per 1000 cubic feet of gas sold ; being an increase of $19,843 and a decrease of 0·6c. respectively as compared with 1894-5. The average price paid by consumers for coal gas to the companies selling annually more than 30 million cubic feet each was $1·12 per 1000 cubic feet. Excluding the Boston and Brookline Companies, the average was $1·22. The average price received by the remainder of the coal-gas companies from sales by meter was $1·68 ; making for all $1·17 per 1000 cubic feet. If the quantity sold by the Bay State Company to other companies is included in the computations, the average price received by all the companies comes to $1·05 per 1000 feet, and by those selling annually more than 30 millions to $1. The average price for oil gas last year was $3·93 per 1000 cubic feet. The average price paid for coal gas in 1886 was $1·72 ; in 1887, $1·66 ; in 1888, $1·56 ; in 1889, $1·45 ; in 1890, $1·39 ; in 1891, $1·31 ; in 1892, $1·28 ; in 1893, $1·27 ; in 1894, $1·26 ; and in 1895, $1·10. Reductions in price were made by 15 companies during the year ; and in only one case was the figure raised. There are 22 companies supplying water gas ; and nine selling oil gas. In the manufacture of the former,

the material used in the generator is mostly anthracite; the enricher being naphtha or gas oil. Naphtha is used for the production of oil gas in six cases, gas oil in two, and petroleum in one. During the past year, about 104 miles of mains were laid. The total number of meters in use on June 30 last was 166,295, representing a nominal capacity of 1,073,974 lights; being an increase of 15,894 meters and 79,356 lights as compared with the previous year. High-power lamps are largely adopted in the various towns. Fall River has 4434 in operation; Holyoke comes next with 3281; and Lawrence makes a good third with 3034. At Cottage City, 2530 Welsbach burners have been placed; while 300 and 250 are in use at Reading and Amesbury respectively. A table is given showing the number of gas-stoves fitted up on June 30 last. Brookline heads the list with 19,002; Boston comes next with 12,827; Roxbury and Dorchester following with 8154 and 6206. Amherst and Lexington have one each; but there are only seven companies who return less than ten. With regard to public lighting, there was a decrease of 460 in the number of public lamps at Brookline, and an increase of 147 at Dorchester. Out of 34 gas companies making returns, the total increase was 296, and the decrease 559—a drop of 263. The total number of public gas-lamps in the State is 11,656. The gas portion of the report closes with some particulars as to the testing work of the department, which has already been noticed (see *ante*, p. 611).

As to electric lighting, the following figures show the results of the operations of the central stations in the State for the year ending June 30, 1896: Receipts for light and power, $4,148,682; from other sources, $38,578—total, $4,187,260. For the preceding year, the total was $3,822,196. The expenses last year amounted to $2,739,783; leaving a balance of $1,447,477, of which the sum of $211,154 was profit earned by gas companies in their electrical departments. The electric light companies therefore made a profit of $1,236,323. Adding the income from rents, jobbing, &c., $200,567, there is shown a total of $1,436,890, against which have to be placed the charges for interest, dividends, depreciation, &c., amounting to $1,402,000; leaving a surplus of $34,890 for the year, against a deficit of $182,249 at the close of the previous twelve months. Four of the companies appear not to have earned expenses; and thirty others did not make sufficient to warrant the declaration of any dividend. The gross profits of the companies doing only an electric business increased over the preceding twelve months by $209,081; and though the charges for interest and dividends were higher, the net result of the year's operations was, as stated above, a surplus instead of a deficit. Particulars are furnished as to the systems employed by the companies, and the maximum dynamo capacity stated in lamps of certain nominal candle powers; as well as the capacity of the power generators in operation; the length of wires and conduits, the number of poles, and the length of streets with overhead wires; the number of commercial lights of the different kinds installed, and the customers using each kind; the number of public lamps of each candle power in use, with the price paid, and the hours they were run; and, finally, the prices charged by the several companies.

The statistical portion of the report is preceded, as usual, by an account of the administrative and judicial work of the Commissioners, as also of the accidents resulting in death or bodily injury, from gas or electricity, which were officially notified to them. Their attention was called to 76 instances of escaping gas, which caused the deaths of 51 and injury to 118 persons, besides one case in which injuries were received by several firemen not included in the above number. This is a large increase over last year. Electricity was responsible for seventeen accidents, resulting in the deaths of five persons and injury to twelve others. Particulars of all these cases are given. The Commissioners feel it to be their duty to call attention to the increase in the number of accidents from illuminating gas. They admit that many are cases of suicide; and, while others may point that way, a close examination tends to show that some of them were more likely due to imperfect fittings. They recommend that all gas companies should make a thorough inspection of the taps of burners before supplying gas to any building, and should require the taps not only to be in perfect order, but provided with stops to prevent them being turned beyond the point necessary to shut off the supply. They remark that the laying of mains in the streets of large cities is sometimes of necessity done in a hurried manner, at the expense of safe and satisfactory construction; and when it is borne in mind that the lives of hundreds of residents along the streets are liable to be imperilled from work executed in this way, they think it must be evident to all that too much care cannot be expended on these operations.

Kimberley Water-Works Company, Limited.—The annual meeting of this Company was held last Wednesday, at the Cannon Street Hotel. The working account presented showed a balance of £25,325; and, after providing for interest on debentures and depreciation, the net available profit was £18,690. Out of this, it was proposed to write off £3292 from construction, to transfer £2799 to the contingency fund, and to pay a dividend of 4 per cent. for the year—absorbing together £12,600. The Chairman (Mr. A. J. Macdonald), in moving the adoption of the report, said the result of the working during the past year justified the hope he expressed at the previous meeting in regard to an improvement in the business. The consumption of water during the year was the largest since 1892; but the consumption in the opening months of this year would not, as compared with the corresponding months of 1896, seem to indicate that the same degree of prosperity would be maintained. This was due to the fact that an abnormal quantity of rain fell at the end of last year; but it was hoped that the consumption during the remaining months of the half year would compensate for the falling off in the first three months. A commencement had been made during the year towards the reduction of the debenture debt, by not issuing the 6 per cent. debenture stock to replace the bonds drawn for redemption. The result of the year was, he thought, eminently satisfactory; and he congratulated the shareholders on the increase in the dividend. Mr. J. Jackson, in seconding the motion, said the report was the best they had for several years. The figures were, on the one side, very satisfactory as showing increased sales of water; but, on the other, not so satisfactory as showing an increase in the expenses of working. He referred to the reasons for this; and also mentioned that the plant had been kept in the highest state of efficiency out of revenue. The Solicitor explained the nature of an appeal to the Privy Council which was still pending, and which it was believed will be heard this session. The motion was unanimously carried.

THE SUPPLY OF WATER GAS IN BIRKENHEAD.

Report by Professor Vivian B. Lewes.

In the "JOURNAL" last week, we gave some extracts from the report presented to the Gas Committee of the Birkenhead Corporation by Professor Vivian B. Lewes, on the subject of the supply of water gas in the borough. We have since received from the Gas Engineer of the Corporation (Mr. T. O. Paterson, M.Inst.C.E.) the full text of the document, which is of sufficient importance to justify its reproduction. It will be remembered Professor Lewes arrived at the following conclusions: "(1) That there is no danger in sending out as a town supply a mixture of coal and cannel gas with carburetted water gas, provided that the carbon monoxide in the mixture does not exceed 17 per cent., which, with the two gases as at present made, would give a limit of 50 per cent. of water gas. (2) That mixtures containing 50 per cent. and under of carburetted water gas are for all practical purposes as good as cannel and coal gas, whilst for use in incandescent mantle lighting they are superior." The experimental data and other reasons upon which these conclusions were based are fully set out in the report, in the following terms:—

I visited Birkenhead on March 3, 1897, and collected samples for analysis of purified coal and cannel gas, carburetted water gas, and the mixture of coal and cannel gas with carburetted water gas, which was being sent out into the town. I also made tests on the illuminating values, specific gravity, and calorific value of the various gases; and herewith give details of the results:—

I.—*Coal and Cannel Gas.*

	I.	II.	Mean.
Hydrogen	47·37	48·01	47·69
Saturated hydrocarbons	36·04	35·42	35·73
Unsaturated hydrocarbons	4·96	4·80	4·88
Carbon monoxide	6·00	5·98	5·99
Carbon dioxide	0·00	0·00	0·00
Oxygen	0·99	0·89	0·94
Nitrogen	4·63	4·90	4·76
	100·00	100·00	99·99

II.—*Carburetted Water Gas.*

	I.	II.	III.	Mean.
Hydrogen	40·22	38·37	39·72	39·44
Saturated hydrocarbons	16·80	17·12	16·72	16·88
Unsaturated hydrocarbons	8·72	8·66	7·32	8·23
Carbon monoxide	28·74	28·57	29·78	29·03
Carbon dioxide	0·00	0·00	0·00	0·00
Oxygen	0·14	0·38	0·13	0·21
Nitrogen	5·38	6·90	6·33	6·20
	100·00	100·00	100·00	99·99

III.—*The Mixture Sent Out.*

	I.	II.	Mean.
Hydrogen	44·62	43·97	44·29
Saturated hydrocarbons	28·69	29·21	28·95
Unsaturated hydrocarbons	6·85	6·64	6·74
Carbon monoxide	14·50	14·48	14·49
Carbon dioxide	0·00	0·00	0·00
Oxygen	1·04	1·08	1·06
Nitrogen	4·30	4·62	4·46
	100·00	100·00	99·99

These were taken on an open bar photometer (Letheby), with certified candles as the standard.

	Candles.
I.—Coal and cannel gas	22·3
II.—Carburetted water gas	22·7
III.—The mixture sent out	21·3

The lower value ascribed to the mixture is probably due to its having been through the holder, and made from perhaps slightly lower value gases on the previous day.

Our knowledge of the specific hydrocarbons of the saturated and unsaturated series present in illuminating gases is so limited, and the exact determination of the quantities present so fraught with difficulty, that no calculation of the calorific value from the analysis is possible; and determination by calorimetric methods becomes necessary. In the following determinations, the Junkers calorimeter was used with all necessary precautions; the results being expressed in the number of pounds of water raised 1° Fahr. by the combustion of 1 cubic foot of the gas. Each result is the mean of a considerable number of closely agreeing experiments. In the first or "gross" determination, the heating value represents the total heat generated by the flame, and recovered from the products of combustion; but in the use of gas-stoves, and in most other cases in which gaseous fuel is employed, the heat latent in the water vapour produced by the combustion escapes and is lost, as no condensation takes place. This is allowed for in the net value, which represents the heating value of the gas as ordinarily consumed:—

Coal and Cannel Gas.

Gross calorific value	746·04	B.T.U.
Net calorific value	676·44	"

Carburetted Water Gas.

Gross calorific value	677·08	B.T.U.
Net calorific value	641·08	"

From this it will be seen that, though there is a difference in the gross value in favour of the coal and cannel gas amounting to a little under 10 per cent. (9·4), yet in the net value, which is the one affecting the ordinary consumption in stoves, gas-cookers, &c., it is only 5·5 per cent. This is due to the carburetted water gas containing a smaller total proportion of hydrogen than is the case with the coal and cannel gas, and so forming less water vapour during combustion.

Where the composition of the gas is known, the specific gravity can be arrived at by calculation; but, with the uncertainty existing as to the exact hydrocarbons present, it is necessary to determine it by experiment. For this purpose, gas-bags full of carburetted water gas and coal and

cannel gas were conveyed to London, and their specific gravities determined by means of the Lux gas balance, with the following results:—

Coal and cannel gas	·549
Carburetted water gas	·647

The products of combustion yielded by coal and cannel gas and carburetted water gas are identical, and in each case consist of carbon dioxide and water vapour. The coal and cannel gas uses up a trace more atmospheric oxygen than the carburetted water gas, and yields rather more water vapour; so that the mixed gas would certainly have no more deleterious effect upon the atmosphere and health than the coal and cannel gas alone.

For gas-engines, the efficiency of the mixture as sent out would be from 1 to 2 per cent. less than with the coal and cannel gas alone; while the risk of forming an explosive mixture by a leakage of the mixture into air would be no greater than with the ordinary town supply.

From the foregoing data, it is possible to answer the questions submitted to me.

1.—*What would be the constituent parts of mixtures containing one-fifth, one-third, and one-half respectively of carburetted water gas with coal and cannel gas?*

Assuming that your method of manufacture and materials remain as at present, the approximate composition of these mixtures would be:—

	One-fifth. C.W.G.	One-third. C.W.G.	One-half. C.W.G.
Hydrogen	46·05	44·92	43·56
Saturated hydrocarbons	31·95	29·47	26·31
Unsaturated hydrocarbons	5·54	6·00	6·55
Carbon monoxide	10·60	13·65	17·51
Carbon dioxide	0·00	0·00	0·00
Oxygen	0·80	0·69	0·58
Nitrogen	5·04	5·25	5·48
	99·98	99·98	99·99

2.—*What would be the relative value as an illuminant when used in the above proportions?*

Carburetted water gas is now being made in Birkenhead as an adjunct, not as an enricher, of the coal and cannel gas; and as both gases are of practically the same illuminating value, alterations in the proportions in which they are used will in no way alter the illuminating value.

3.—*What effect would the above mixtures have on fittings and burners?*

The same fittings and burners as are at present used for the coal and cannel gas will answer perfectly well for mixtures not containing more than 50 per cent. of carburetted water gas; but if it is desired to burn carburetted water gas alone, the burners would have to be altered.

4.—*What would be the loss of heat for warming purposes, cooking-stoves, &c., entailed by the use of such mixtures?*

From 1 to 2¾ per cent.—an amount which is totally inappreciable when the very large percentage of heat lost in all stoves, cookers, and engines comes to be considered.

5.—*What are the explosive properties of such mixtures when mingled with air?*

Practically identical with those of the coal and cannel gas.

6.—*What would be the relative effect of the products of combustion from such mixtures upon health, as compared with coal and cannel gas, where used for illuminating and heating purposes?*

Where combustion is perfect, there will be no difference in the effect upon health, and complete combustion is rather more easily attained with the mixture than with the coal and cannel gas.

7.—*What are the mixing powers of carburetted water gas with coal and cannel gas?*

An idea seems to exist that, owing to the different specific gravity of the two gases, a mixture of equal volumes placed in a gasholder is liable to separate or "layer," so that the town supply might be practically all coal and cannel gas during one period, and pure carburetted water gas at another. If the holder were half filled with coal and cannel gas, and then filled up with carburetted water gas, there would be a risk of this; but if, as is the case, the gases are made to mix *pro ratâ* at the inlet to the holder, they flow into it together, and diffusion will keep them as a perfect mixture. It must be borne in mind that, if this were not so, the constituents of coal gas itself would separate in the holder; and non-luminous hydrogen would be found at the top, and the heavy hydrocarbons at the bottom.

8.—*What is the effect of the products of combustion from carburetted water gas upon books, gilded work, &c.?*

Most of the sulphur in carburetted water gas being in the form of easily removable sulphuretted hydrogen, the purified gas is far more free from sulphur compounds than is the case with coal and cannel gas; and as a result the action of its products of combustion is less harmful than that of those yielded by the latter gas.

9.—*Are incandescent mantle burners, as generally supplied, better suited for consuming a 20-candle power coal and cannel gas, or a mixture of it with carburetted water gas of the same illuminating value?*

Incandescent mantle burners are generally regulated for the consumption of a 16-candle gas; and the result is that, with a 20-candle coal and cannel gas, deposition of carbon on the mantle, and consequent loss of light, frequently takes place. A 20-candle carburetted water gas requires slightly less air for its combustion; and for this reason the mixed gases would be better adapted for use with mantle burners than the coal and cannel gas alone.

10.—*What proportion of carburetted water gas can with safety be mixed with the town supply, having in view the poisonous properties of carbon monoxide?*

In giving an answer to a question of this character, a grave responsibility is undertaken; and I should decline to do so were it not that, in my position as Superintending Gas Examiner to the Corporation of the City of London, I have been obliged to consider very carefully to what extent carburetted water gas might be allowed to replace coal gas without danger to the consumers.

It must be clearly borne in mind that carbon monoxide is the most dangerous gaseous poison there is; and the attempts made by some supporters of carburetted water gas to gloss over this fact are as mistaken as they are mischievous.

The only proper way to attack this question is to grasp the fact of the dangerous properties of the gas, and then to so arrange the percentage of it in the town supply that only under abnormal and accidental conditions, impossible to prevent, should it become dangerous; the same conditions being equally a source of danger with the ordinary gas supply.

The breaking of a gas-main near the basement of a house, and infiltration of large volumes of gas into the house itself, the fall of a chandelier, or a serious leakage from it when pulled too low, and the accidental cutting into a supply-pipe in a wall, would all give leakage of a sufficiently serious character to form a poisonous mixture fatal in time to life, whether the escaping gas were coal or carburetted water gas; and this class of accident must be put aside.

The smell of carburetted water gas being even more penetrating than that of coal gas, a leakage becomes apparent to the nose when the air contains 1 of gas to 10,000 of air—a proportion absolutely without action on health. From this it follows that it would only be during sleep that the leakage of a sufficient quantity of carburetted water gas to become dangerous to life could happen; and the leakage, under these circumstances, would only take place from a person going to sleep with the gas burning, and someone cutting off the gas at the meter and then turning it on in the early morning, or by the more likely chance of turning off the gas-burner and accidentally turning the tap on again, either through a worn stop on the tap, or catching the tap in withdrawing the hand. The usual chances of leak adduced are from such unlikely circumstances as the gas being blown out (an extremely difficult thing to do), or being extinguished by collection of water in the supply-pipe, or by an irregularity in the working of the meter; and I freely admit that, in a fairly long experience of coal-gas consumption, no such instances have come to my knowledge. But they are possibilities.

In any case, the amount of gas escaping into a room under these conditions will not exceed that passed by an ordinary flat-flame burner, or (say) 6 cubic feet per hour. A small bedroom will contain at least 1000 cubic feet of air space; and experiments which I have made show that in a room of this size, containing a fireplace, a door, and a window (the two latter being closed and no fire in the grate), the whole air in the room is changed at least twice an hour, generally nearly three times.

We have now to consider the percentage of carbon monoxide in gas which on leakage into the air of a room under these conditions will give a mixture which shall not be dangerous to life even when breathed for a considerable period. The data as to the percentage of carbon monoxide in air which is dangerous to life has for the most part been collected from the action of known percentages upon rabbits and mice. As mice are very susceptible to its action, and rabbits are very little affected by it, considerable discrepancies exist; but even if this were not so, the action of the gas on these animals by no means necessarily indicates the action on man.

Dr. John Haldane, in his now much-quoted work on the effects of carbon monoxide on life, not only experimented on mice, but also tried the effect on himself; and he found that 0·05 per cent. of carbon monoxide in air begins to have an appreciable effect, but can be inhaled for four hours without very marked symptoms. For all practical purposes, therefore, 0·05 per cent. may be taken as the margin of safety. It will probably be urged that a larger proportion will possibly do but little radical harm. But it must be remembered that both coal gas and carburetted water gas contain hydrocarbons, the toxic action of which is but little known; and when the action of these bodies is taken in conjunction with the effect of the carbon monoxide, I think it will be admitted that the limit fixed is a reasonable one.

Taking these factors, it is now possible to formulate the proportion of water gas, with its average of 29 per cent. of carbon monoxide, which may with safety be mixed with coal and cannel gas of the kind made at Birkenhead, and containing 6 per cent. of the gas. If gas escapes into a room having a capacity of 1000 cubic feet at the rate of 6 cubic feet per hour, while the air of the room is changed twice in the hour, then after three to four hours the percentage of gas will rise to 0·3 per cent., and the rate of leakage and of removal by the changing of the air will become constant; and the percentage of gas will not rise above that point, however long the leakage may continue.

It has been shown that 0·05 of carbon monoxide may be inhaled for four hours without dangerous symptoms; and this amount of carbon monoxide will be present if it constitutes one-sixth, or 16·6 per cent., of the mixture. Approximately, this composition is arrived at with a mixture of one-half coal and cannel gas and one-half carburetted water gas; and it should be clearly understood that this proportion should not be exceeded. Under these conditions, I am of opinion that the mixture is perfectly safe as a town supply.

These figures are given for coal and cannel gas of the quality and composition of that made at Birkenhead. But it must be remembered that the carbon monoxide in the coal gas varies with the oxygen present in the coal carbonized, and that though London gas made from Durham coal only contains from 3 to 4 per cent. of this gaseous bugbear, Edinburgh gas contains an initial percentage amounting to from 10 to 11 per cent.; and the amount of carburetted water gas which can with safety be mixed with the town supply will vary with the local factors of composition.

11.—*Is carburetted water gas a cumulative poison—i.e., can it be inhaled in small quantities and retained in the system day by day until health is undermined?*

In the continuous breathing of small percentages of carbon monoxide, this might be the case; but if there is any change of *locale*, it would be practically impossible. A person sleeping in a room with a leaky gas-fitting might each night take into his system a small trace of the gas. But in his outdoor life in the daytime this trace would be eliminated; so that, unless confined to one apartment for a very long period, no such action would be likely to happen. In my experience, men exposed to this gas in working producers, &c., soon get used to its effects, and show no loss in health.

The Cray Water Scheme of the Swansea Corporation.—The Water Committee of the Swansea Corporation have adopted certain modifications, suggested by Mr. G. H. Hill (whom they consulted), in the plans and specifications of the new Cray water-works. One important alteration is that the dimensions of the tunnel are to be reduced; and this alone, it is said, will effect a saving of £50,000.

PROPOSED UTILIZATION OF THE WATER POWER OF IRELAND FOR THE MANUFACTURE OF CALCIUM CARBIDE.

A Committee of the House of Commons has recently been hearing evidence in connection with the Industries (Ireland) Bill, which was introduced by Mr. T. Healy. At the sitting of the Committee last Friday week, the chief witness was Mr. Thomas Holliday, J.P., of Huddersfield, who is both an Engineer and Chemist, and whose contribution to the proceedings was an explanation of an interesting (though perhaps, some will think, a rather visionary) scheme for utilizing the water power of Ireland. A visit to the principal parts of the country had convinced him that the mountainous districts were especially adapted for producing electric power by the use of water; and he told the Committee of what was done by the Niagara Falls and a large number of smaller falls in Switzerland in the way of chemical production by electricity. A greater heat, he said, could be obtained by this means than by steam, gas, and fire. Whereas formerly by fire platinum could only be melted by the heats then obtainable, now, by the application of electricity, it could be boiled and evaporated. In Ireland, where the water powers available were all small ones for the best part of the year, Mr. Holliday thought, a higher and more satisfactory power would be obtained if they built reservoirs. In some cases they would be near large towns and villages; and many of these, he was sure, would be willing to be lighted by electricity. The electricity could be utilized in the manufacture of calcium carbide, which was produced by melting, under electric heat, coal and lime at a temperature of 2500° or 3000° C.—three times as hot as melted iron. At this heat, the two bodies ran together melted and crystallized. When this body was put into water, a pound of it generated 5 cubic feet of gas, which would give a light of 250-candle power per hour. Common coal of equal amount would yield 25 feet of gas, or say 18 candles an hour. The consequence would be that, if instead of converting coal into gas, as at present, they took a ton of coal, which gave 30,000-candle power an hour, and converted it by electricity into carbide of calcium, they would be able to produce a light nearly equal to 1,000,000 candles. The coal in Ireland was not of sufficiently good quality for the production of this gas, so that it would be necessary to import coal; but the charge would not be very large. A considerable amount of carbide was produced at the Niagara Falls at the cost of £15 per ton; but by the time it reached England, owing to the high freights charged on account of the scare arising from the alleged danger of explosions, the price reached about £28. If they were able to manufacture it in Ireland, the charge would soon go down to about £10, and ultimately even lower. The proportions of coal and lime used in the manufacture were about one-third and two-thirds respectively. If the price of carbide were reduced to about £10, the light given from it would be the cheapest in the world. In reply to a member, Mr. Holliday said there was as much gas given off from 1 lb. of calcium carbide as would give five 50-candle lights for an hour. At present it would be worth 3d.; but if made in Ireland in the way outlined, it would not cost more than 1d. He also mentioned that the French Government had made a grant to their Chemist, M. Moissan, of 200,000 frs. to continue his experiments with this gas, so valuable did they consider its advantages. The mountain streams in the districts visited by Mr. Holliday could, in his opinion, be "harnessed," so as to produce the requisite amount of water power for the manufacture of carbide of calcium; but he did not think any private firm or company would dream of going in for a Private Bill to promote the industry, owing to the conflicting interests they would have to meet, and because of the great public benefit that would be conferred. It was not proposed to store acetylene; this had been tried, but had proved to be too dangerous. In England, carbide of calcium gas was used for lighting shooting-boxes, and in one or two cases railway-stations. In all cases it had given satisfaction. Concluding his evidence, Mr. Holliday said that the ordinary gas in Irish towns was much dearer than in England, while a good many of the towns were lighted by oil. There was no lack of lime throughout Ireland; so that the manufacture of gas would not suffer on that account.

THE NITROGENOUS BYE-PRODUCTS OF GAS-WORKS.

Our contemporary the "Engineer" recently devoted an article to the above-named subject, in view of the unexampled depression which has lately prevailed in the market for some of the most valuable gas-works residuals. Evidence of this depression was afforded by the last parliamentary returns; but its full effect will not be known until the issue of those for 1896-7, at the close of the present year. The loss of revenue will, no doubt, be serious; and therefore prompt measures are needed to repair it. It is pointed out that coal gas holds its own in this country solely by reason of the commercial utilization of the bye-products of its manufacture; and therefore fair returns from the sale of these are indispensable to its prosperity, and even its existence. As a first step towards seeking a remedy for depression, it is necessary to clearly comprehend the conditions which control prices; and these the writer proceeds to consider.

The most important bye-products of gas-works are coke, tar, and ammoniacal liquor. The value of coke in any district is controlled by the current prices of coal or other fuel. The value of tar fluctuates with the state of activity of the market for chemicals, of many of which it is the readiest raw material. When chemical industries are depressed, many gas-works find it more economical to use tar as fuel than to dispose of it to the distilleries and chemical works. However depressed be the market, the gas manager cannot refrain from producing coke and tar; and the same may be said of ammoniacal liquor. The latter is the commonest source of ammoniacal products in this country. Tar and ammonia are now recovered as bye-products in many other industries; but the recovery in such cases may be interrupted so soon as it becomes unremunerative. It is, however, essential to the proper cleansing and purification of coal gas prior to distribution that tar and ammonia should be entirely removed from it; and therefore the gas manager cannot restrict the amount of either which he obtains. In the face of an overstocked market, tar may be consigned to the furnaces. There is, however, no such convenient outlet for a surplus of ammoniacal liquor should ammoniacal products be over-abundant. The difficulty of the gas engineer's position with regard to ammoniacal liquor will be made evident by a consideration of its origin and utilization.

English gas coals contain from 1 to 2 per cent. of nitrogen, of which about one-seventh is ordinarily found combined in the form of ammonia in the crude gas. The ammonia, with other constituents of the crude gas, is removed therefrom by the processes of condensation and scrubbing or washing, and is then contained in the complex aqueous solution known as ammoniacal liquor, of which it forms the most valuable component. It is recovered in the form of some ammonium salt from the liquor. The salt ordinarily produced is ammonium sulphate; but occasionally some other—*e.g.*, the nitrate—may be made in response to a temporary call for it. Prices will, however, rapidly adjust themselves according to the laws of supply and demand; and we may safely assume that the value of the ammonia in ammoniacal products is indicated by the current price of ammonium sulphate. For estimating the value of the ammonia in coal gas, we will, therefore, consider that it is worked up solely into that salt. At the close of last year, ammonium sulphate was quoted at a little over £7 10s. per ton. At the close of 1895, the price was £8 11s. 3d.; and six months earlier it was £9 15s. During that six months, strangely enough, the largest gas undertaking in the kingdom was withholding the bulk of its production of ammonium sulphate from the market, and was storing it, at much expense, in a vain attempt to inflate its value. Now, the production of ammonium sulphate from ammoniacal liquor in works where complete recovery of ammonia is effected, accounts for only one-seventh of the nitrogen of the coal, or about 0·025 per cent. of the weight of coal carbonized. Assuming that the ammonia is completely recovered in all the gas-works of the United Kingdom, no less than 30,000 tons of nitrogen, combined in the form of ammonia, should have been at the disposal of these works in the year 1896. This quantity would yield 130,000 tons of ammonium sulphate. The average value of the product was about £1 15s. per ton less in 1896 than in 1895; therefore the net loss of potential revenue in 1896 to the gas undertakings of the United Kingdom, due to the diminished value of ammonium sulphate, exceeded £200,000. The consideration of means by which this loss may be made good in subsequent years brings us back to the general question of the distribution of the matter constituting coal among the products of its carbonization, and in particular to the question of the distribution of the nitrogen.

We have seen that only one-seventh of the nitrogen of the coal is ordinarily recovered in the form of ammonia from coal gas. Nearly one-half of this nitrogen remains in the coke; and various schemes have been proposed for increasing the amount of ammonia in the gas at the expense of the nitrogen of the coke, in which it is useless. The prevailing low value of ammonia has at the present time diverted attention from them. There is a small amount of nitrogen locked up in coal tar; but the problem of its recovery may be left to the tar distiller. Nearly the whole of the nitrogen of the coal so far unaccounted for will be found as such in the gas; but a small amount may be recovered in the form of cyanogen, or compounds thereof. The proportion which may be so recovered is only about 0·025 per cent. of the weight of coal carbonized. Though so small a fraction of the coal, this nitrogen can no longer be neglected, because cyanogen is a combination into which it is difficult to coax that inert element; and certain compounds of cyanogen are in great demand at the present time. We allude to the cyanides of the alkali metals, potassium and sodium, which are used indifferently in large quantities for the extraction of gold from its ores. A solution containing only 0·25 per cent. of potassium cyanide, or a rather lower percentage of sodium cyanide, will dissolve out from low-grade ores such as occur in the South African gold-fields from 70 to 90 per cent. of the gold they contain. It has been found that about 40 lbs. of potassium cyanide will be consumed in the extraction of 1 lb. of gold from such ores. Pyritic gold ores need preliminary treatment, and cupriferous ores are wasteful of the cyanide. But, generally speaking, cyanide extraction is applicable to a large proportion of low-grade gold ores. At the close of 1896, potassium cyanide (98 per cent.) was worth 11½d. per pound; whereas at the close of the previous year it was worth 1s. 4d. The demand for potassium and sodium cyanides, caused by their use for gold extraction, has opened up many new sources of supply; and their prices have already dropped somewhat. In general, it may be said that the cyanogen of the commercial cyanides has at one stage of their production passed through the form either of ferrocyanide or of sulphocyanate. Ferrocyanide is at present more cheaply convertible into cyanide than is sulphocyanate; but the advent of a new process may at any moment reverse their positions as sources of cyanide. For the present, however, the aim is to obtain, wherever practicable, ferrocyanide, as the stepping-stone to the commercial cyanides.

Ammonia and cyanogen both contain nitrogen; yet the commercial value of the nitrogen in the two forms is very different. The percentages of nitrogen in ammonium sulphate and in potassium cyanide are almost identical; but at the close of last year, the latter substance fetched nearly fifteen times the price of the former. There are processes now at work for the conversion of ammonia into cyanide by the intermediate formation of sulphocyanate; but the ratio between the values of the nitrogen in the form of ammonia and in the form of cyanogen proves that the conversion is costly. Seeing that gas-works of necessity produce ammonium compounds, of which there is now a plethora, self-interest should dictate to those responsible for their management the policy of fostering researches which may culminate in the discovery of a cheap process for the conversion of ammonia into cyanogen. In the meantime, the cyanogen already to hand in the gas must no longer be neglected. As already pointed out, it accounts for but a small proportion of the nitrogen of the coal; yet if this cyanogen were recovered throughout the gas-works of the United Kingdom and converted to potassium cyanide, no less than 14,000 tons of that product would annually result. A very great fall in the prices of cyanides might occur before the value of such a quantity would be less than one million sterling. Had the recovery of so valuable a bye-product from coal gas rested on mechanical rather than on chemical principles, the gas engineer would long since have achieved it. The services of a trained chemist are, however, too seldom sought in a modern gas-works; and the mere gas tester, who often usurps that title, is quite incompetent

to solve the recondite problems which the recovery of cyanogen from so complex a mixture as coal gas presents.

Let us briefly glance at what has already been done towards the recovery of cyanogen from coal gas, and we will now only consider processes which aim at the production of ferrocyanide as the most suitable form for conversion to commercial potassium or sodium cyanide. In 1891, a specification was filed by W. L. Rowland, of Philadelphia, U.S.A., for "A process for recovering cyanides from coal gas." The features of this process are the addition of an iron salt to the water or liquor with which the washer is filled, and the working up of the ferrocyanide found in such liquor, when it is run off, into commercial potassium or sodium ferrocyanide. The whole of the cyanogen which enters the washer is retained by the iron, which forms ferrocyanide with it and the ammonia of the liquor ammonium. The ordinary washer or scrubber may be used for the process; and the recovery of the ferrocyanide is effected along with the recovery of the ammonia. In these and other important points, the cyanogen-recovery process introduced at the Beckton Gas-Works about two years ago is absolutely identical with that protected by Rowland. In May, 1892, Mr. W. Foulis, of Glasgow, protected an invention for obtaining cyanides from illuminating and heating gas. The salient feature of the invention is the scrubbing of the gas after it has passed through the ordinary washers, and is therefore free from ammonia, with a solution of potassium or sodium carbonate, bearing in suspension carbonate or oxide of iron. A suitable method of preparing the scrubbing medium, and suitable patterns of scrubbers, are described in the specification. The cyanogen is removed from the gas by the scrubbing medium, wherein it is found as potassium or sodium ferrocyanide, which is recovered as such. The third process to which we will refer is the dry one, devised by Knublauch. The extraction of cyanogen is carried out by it at a later stage. The gas is thoroughly washed, and the ammonia completely removed from it in the ordinary way. In the usual course of gas-works procedure, it would pass to the purifying vessels, the first one of which is in the English routine charged with slaked lime, and the second one with hydrated ferric oxide. Continental practice often reverses the relative positions of the lime and oxide vessels. Either material will remove cyanogen from gas; but it can only be readily recovered from ferric oxide. Knublauch therefore places a purifying vessel charged with oxide first in the series, and converts the cyanogen, which that material retains as ferrocyanide, into the sodium or potassium salt.

The three processes we have mentioned have been tried on a fairly extensive scale, and exemplify three distinct views as to the best means of recovering cyanogen from gas. The Beckton process attacks the gas at the earliest possible moment after it leaves the retorts. It requires only the pattern of washer-scrubber which is commonly used for the extraction of ammonia from gas, and is therefore familiar to the gas engineer. The ammonia and cyanogen are removed from the gas simultaneously, and retained in the liquor. Their recovery from that *olla podrida* will not directly fall on the gas engineer, but on the liquor-works chemist. The whole of the cyanogen in the gas entering the scrubbers may be recovered by this process; and therefore it deserves consideration. It is crude in the extreme, but does not introduce new apparatus to the gas-works, and lifts from the shoulders of the gas manager, who is seldom a chemist, the chief burden of the extraction. Mr. Foulis, on the contrary, uses a special washing or scrubbing apparatus, but secures commercial potassium or sodium ferrocyanide by simple operations, the routine of which may readily be learned by the gas engineer. It should be noted, however, that the gas is not attacked at so early a stage as it is by the Beckton process, and that only the cyanogen which passes out of the ordinary scrubbers with the gas is recoverable. This remark applies also to Knublauch's dry process, which demands a change in the customary order of the purifying vessels, and therefore will not commend itself to gas managers who have learnt by rule-of-thumb one system of purification. The fates of these three processes must be to a very great extent determined by the economy with which the strictly chemical manufacturing process peculiar to each of them is carried out. Let us make the position clear. The Beckton process will be favoured by cheap recovery of ferrocyanide from the scrubber liquor; the Foulis, by cheap preparation of the scrubbing medium; and the Knublauch, by cheap recovery of ferrocyanide from the ferric oxide.

ELECTRIC LIGHTING NOTES.

The Portsmouth Corporation Electric Lighting Committee have resolved to reduce the charge for current by ½d., to 4½d. per unit. When the works were started in June, 1894, the price was fixed at 6d.; and twelve months later, it was brought down to 5d.

The result of the recent election of the new District Council at Newmarket, which was fought upon the question of whether or not the town should have the electric light, is a majority in opposition to the scheme. The Provisional Order applied for by the old Council will not therefore be proceeded with.

The new electric lighting works of the Harrogate Corporation were opened last Wednesday with due formality. The principal part in the ceremony was performed by Colonel Thwaites, the Chairman of the Electric Lighting Committee; and he was assisted by the Mayoress (Mrs. J. H. Wilson) and Mrs. Thwaites. In celebration of the event, a banquet was afterwards given in the Queen Hotel. The cost of the works has been about £25,000; and the Corporation commence their new business with close upon 100 consumers, representing between 7000 and 8000 8-candle power lamps.

Professor Kennedy has reported to the General Purposes Committee of the Carlisle Corporation upon an electric lighting scheme for the city; and the Committee take such a hopeful view of the success of the undertaking that they have resolved to extend the area of lighting with which it was originally intended to start. The cost of the proposed works is put at £22,000. In his report, Professor Kennedy gave a number of figures which went to show that, with 7000 lamps wired in the central district, a net profit of £400 per annum would be secured; but the total income from the whole scheme, with about 14,000 lamps wired, would give a net profit of £1650.

A shocking accident occurred last Tuesday at the Bristol electric light extension works. One of four massive pile-driving engines was being shifted on its platform, when the mass of iron, weighing a ton, fell over. As this was attached to the cap of the pile-driving engine by a steel rope, it pulled down the heavy structure. This fell upon the gang of men attending to it, and crushed Francis Stone, the ganger, so badly that he died in a short time. The foreman of the works, named Reynolds, was dashed against the doors of the machine-room, crushing his face and ribs. He was picked up in an unconscious state, and taken to the hospital, where it was found that a broken rib had penetrated the lungs. Another man named Parker had his legs injured.

The Belfast Corporation specially met yesterday week to consider a report by the Electric Lighting Committee, in which it was recommended that application be made to the Local Government Board for sanction to the raising of £65,000 for the first section of the electric lighting extension works. Mr. Andrews, in moving the adoption of the report, said the approximate cost of the additional mains and plant was £50,270; and of the buildings to accommodate the machinery, £15,000. The Committee considered the sums they asked for would be sufficient to meet the requirements of electric lighting for, at any rate, the next two years. Further information regarding the proposals of the Committee was sought by some of the members; and, on the motion being put, only two votes were recorded in opposition to the recommendation.

Last Tuesday, Sir Courtenay Boyle, Secretary to the Board of Trade, held an inquiry at Whitehall, into an application of the British Insulated Wire Company, of Prescot, for power to establish electric lighting in the districts of Huyton, Whiston, and Rainhill. A full inquiry was held locally last year by Major Cardew; and the Board would not then allow the issue of a Provisional Order. At that time it was urged, on behalf of the Local Authorities, that they were perfectly willing to supply the electric light when there was a demand for it; and the same stand was again taken. The promoters, it appeared, had circularized the inhabitants promising them free wiring; but, even with this inducement, only 84 persons had signed provisional agreements in the districts in question—some of them being pecuniarily interested in the Company. For the applicants, it was submitted that owing to the inaction of the Local Authorities, this was a case in which the Board of Trade should dispense with their consent. Sir Courtenay Boyle said he would take time to consider the representations that had been made by the parties.

Readers of the "JOURNAL" have had before them from time to time the views of the Mayor of Redfern (N.S.W.) on the subject of the electric lighting in that town; and judging from what transpired at the meeting of the Council not long ago, as reported in the "Sydney Morning Herald," they are supported by not a few of the inhabitants. We learn that, on the occasion referred to, considerable discussion took place with regard to a letter received from a Mr. Rowan, who stated that he had been charged an exorbitant price for the use of the electric light during the past quarter as compared with his previous quarter's charge. He said he had reduced the lighting in his house and shop from 230 to 120 candle power—a difference of 110 candles—but he had been charged, notwithstanding the decreased amount of light consumed, £2 more than he had ever paid before. He stated that he had complained of this charge to the Mayor, who had given instructions to have the meter used by him subjected to a proper test by the Electrician; and on being tested, it was found to be correct. Alderman Crowe said that, in his opinion, the meters as used by the Council were nothing less than a farce. He referred the Council to his own charge for the electric light, which was less in the winter months than in the summer. Alderman Poole denounced the electric light system as a humbug, and an expensive as well as a miserable undertaking. He moved that, as the extra charge imposed on Mr. Rowan might have been occasioned through leakage in the wires inside that gentleman's house, which would not affect the meter, the Electrican should make an inspection of the premises, and if there was found to be a leakage, it could be rectified, and also that the amount now chargeable to Mr. Rowan be reduced, and put on a basis equal to his previous quarter. This was agreed to.

The minutes presented by the Parliamentary Committee at the meeting of the Sheffield City Council last Wednesday were brief but important. The prominent feature was a resolution expressing the opinion that it was advisable that the Council should put in force the powers reserved to them under section 60 of the Electric Lighting Orders Confirmation Act (No. 4), 1892, and forthwith give notice for the purchase of the undertaking of the Sheffield Electric Light and Power Company, Limited. The minutes were introduced by Mr. Chambers, who explained that the suddenness of the proposal was due to the fact that the Company had voted an increase of capital. Mr. Chambers was one of the members who in times past opposed the starting of electric lighting by the Corporation; and now he had to account for his apparent change of front. He said he held that it was not part of the duty of the Corporation to spend or risk the ratepayers' money in trade speculation; but he saw nothing wrong in providing, as had been done in their case, that, in the event of the speculation turning out successful, the Corporation should have power, upon defined terms, to take over the undertaking. Regarding the resolution on the minutes, he put it to the Council that, if the Corporation were to buy the undertaking, now was the time. It had been stated that, by waiting 10 or 21 years, they would be able to purchase the concern on a slightly better basis. He, however, failed to see the wisdom of waiting, when it was taken into consideration that now they would have to pay a very much smaller capital account; whereas if they waited, the Company would increase their capital. If the undertaking had so far been a success that the shareholders had decided to increase their capital by £200,000, that was quite good enough for the Corporation to exercise their option of purchase upon. After the motion had been seconded, Alderman Gainsford appealed to the members to carry the resolution without discussion, as, he said, any arguments which might be used would be liable to be repeated when the matter of the price was before the Arbitrator. The minutes were carried unanimously; and a formal resolution was passed that notice be given to the Company requiring them to sell their undertaking.

Sales of Shares.—Messrs. Garrod, Turner, and Son last Tuesday offered for sale by auction £2500 of new "C" stock in the Ipswich Gas Company, with the dividend accruing from Jan. 1. The last payment on this class of stock was at the rate of 9 per cent. per annum. The prices obtained were £23 and £23 2s. 6d. per £10 lot; and the total amount realized was £5773 15s. Last week, 25 shares in the Cupar Gas Company were sold for £34 each.

THE LOWESTOFT CORPORATION AND THE WATER SUPPLY.

The rejection by the Lords Committee of the Bill promoted by the Lowestoft Corporation, to give them power to purchase the properties of the Water and Gas Company has caused much unhappiness in the Council. This was very apparent at a special meeting of the members held last Saturday week to consider their position in regard to the matter; a good deal of warmth being imparted into the discussion by the Mayor (Alderman Adam Adams) and one or two other gentlemen. In view of the loss of the Bill, the Special Water and Legal Committee recommended the Council to take steps to procure the insertion in the Bill promoted by the Company of clauses to the following effect: "(1) To compel the Company, under a penalty, to complete the works described in the Bill within a reasonable and specified time. (2) To give the Corporation and their officers a right of entry upon the Company's works upon giving a reasonable notice. (3) To modify the proposed powers of the Company as to water-fittings, and as to dealing with soil-pans and water-closets." Moving the adoption of these recommendations, the Mayor said the loss of their Bill was not through any fault of the Committee. He was sorry the Deputy-Mayor (Colonel Lucas) was not present; for he did not like to say things in the absence of a gentleman which, it might be stated, he would not say if he were there. He (the Mayor) greatly blamed those who had put Colonel Lucas in the witness-box to give evidence; for he was asked questions on matters of which he had no knowledge. The Company needed no better evidence on their behalf than that which was given for the Corporation. They had been stigmatized as not being fit to have charge of the water supply; but if the case had been properly presented to the Lords, a very different complexion might have been put upon it. In promoting the Bill, they did that which, as business men, it was incumbent upon them to do, in the face of a report of Dr. Copeland (one of the Inspectors of the Local Government Board), and what had come to their knowledge. As to the condition of the water, there was a great deal to be said on both sides; but the need for enlarging the supply was proved by the Bill promoted by the Company. A great deal had been said about the money that had been spent; and the opinion had been expressed that those who promoted the Corporation Bill ought to pay the cost. If they had not obtained their Bill, they had got the next best thing—a purer water supply than they had twelve months since. Not a farthing of the money had been thrown away; but the ratepayers had benefited. It was to the credit of the Company that the necessary work had been carried out; but they ought to have done it before. The Company's Bill provided that the water should be pumped direct from Fritton Lake to the filter-beds, which he thought most objectionable; and the arbitrary powers asked for with regard to water-fittings should not be granted. Alderman T. Hobson having seconded the motion, Mr. Thirtle moved an amendment that the recommendations be struck out. With regard to the first clause, he said the supply had always been adequate, although they had passed through very dry seasons. It was not right to bind the Company down to a certain time for the construction of the new works, because the Corporation had under consideration a proposal that the streets should be watered with salt water. If the Corporation would not want the water they now used, there might be no need for the works to be enlarged. There was also a scheme in the air to evade the flushing of water-closets by the Water Company. Two or three times the Mayor interrupted Mr. Thirtle—charging him with anticipating things that had not come before the Council, and ruling some of his remarks out of order. At the close of the discussion, the amendment was defeated by 17 votes to 7. A further amendment, however, was unanimously carried. It was to the effect that the Committee be instructed to immediately enter into negotiations with the Company with the view to procure the insertion of the clauses. It was explained that this would not affect the lodging of the petition by the Corporation against the Company's Bill; but if the negotiations were successful, further expense would be avoided.

Messrs. Fletcher, Russell, and Co., Limited.—The general meeting of this Company was held in Manchester on Monday last week—Mr. T. Fletcher presiding. The Directors presented a report in which they dealt with various important changes proposed in the directorate, consequent upon the growth of the Company's business. According to the new arrangements, Mr. Fletcher will continue Chairman of the Board and be a Managing-Director of the Company; Mr. A. Neil will be the Vice-Chairman, a Managing-Director, and the General Commercial Manager of the Company; Messrs. W. and A. C. Russell will still be Managing-Directors. Mr. J. Neil, Mr. C. Clare, Mr. W. R. Neil, and Mr. E. L. Fletcher, who have held responsible departmental positions were recommended for appointment as ordinary directors, and as assistants to, and ultimate successors of, the present Managing-Directors. The number of Directors will now be eight instead of six. Mr. Rudge, the Assistant-Secretary, is to be Secretary, and be assisted by Mr. W. Russell, jun. The Directors expressed their pleasure in stating that all the works had been busy since last August. The enlarged London show-rooms continued to be of good service; and the removal from King Street, Manchester, to more commodious premises in Deansgate promised well for the Company and their trade customers. Extensions at both Pendleton and Warrington were needed; but these had not been carried out; as it was thought desirable to concentrate and simplify the working of the various departments. After much consideration, a suitable site had been secured at Warrington, adjoining the London and North-Western Railway, in close proximity to the proposed Warrington Docks of the Manchester Ship Canal, and within easy distance of the Manchester, Sheffield, and Lincolnshire and the Midland Railway systems; and the Warrington works would be transferred to this site as early as possible. The Directors considered this a favourable opportunity for carrying out the changes proposed; and they felt confident that in due time the interests of the Company would be profitably affected thereby, and the future stability, progress, and effective working of the business better secured. The alterations in the constitution of the Board, and the other recommendations, were unanimously adopted. The shareholders expressed their satisfaction with the excellent report presented; and the proceedings closed with the usual vote of thanks.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

A correspondence has begun in more than one newspaper in Edinburgh with reference to the poisonous properties of water gas. The carburetted water-gas plant which has been erected in the Edinburgh Gas-Works is about ready for use; and this forms the reason for introducing the subject at the present time. The writers, I am sorry to say, do not put their names to their communications. They, however, appear to be keeping themselves abreast of the times; for the gentleman who started the agitation quotes from the article in the "British Medical Journal," which formed the subject of comment in your editorial last week. He winds up by saying that he intends to cut off his Corporation gas supply so soon as the water-gas plant comes into operation. Well, these alarmist views will do no good now. The Commissioners satisfied themselves, by means of a report from Professor Crum Brown, of the Edinburgh University, before they agreed to introduce the plant, that there was no greatly increased risk of danger to life through the use of carburetted water gas. I did not at the time, nor do I yet, think that Professor Crum Brown's report was anything like exhaustive. It did not, for instance, take any account of the possibility of the gas layering in the holders, which I consider is of more importance in dealing with the question of whether the gas is dangerous or not, than was the fact that the percentage of carbonic oxide was comparatively small, and that by carburetting the gas an odour was communicated to it which removed the risk of a person being overpowered before he was aware that he was breathing anything deleterious. Of course, such an investigation was not a chemical, but an engineering one; and Professor Crum Brown was consequently not the appropriate person to undertake it. For all this, the inquiry should be made, in order, if possible, to allay the fears which undoubtedly exist in the minds of many gas consumers as to the dangerous nature of water gas. But I do not go into the matter further just now, because a few months, at most, may put the whole subject of gas enrichment in a new setting. There are two possible ways in which this may happen; but neither of them is ready for publication, and therefore, both with regard to them and to the use of carburetted water gas, a policy of waiting is to be commended.

This week my duties have led me into the perusal of a file of newspapers dating back to the thirties and forties. There are in them some quaint references to gas matters. In one issue, there are advertisements beside each other, by the Edinburgh Gaslight Company and the Edinburgh and Leith Company, announcing a reduction of the price of gas from 8s. 6d. to 7s. 6d. per 1000 cubic feet. There is an announcement, about 1844, that a Mr. Russell was to explain, in a popular lecture, the properties of his patent hydrocarbon gas. About that time, the railway fever was on. The Edinburgh and Glasgow Railway was opened in 1844. Just before the opening day, there was a sort of press view; and in the account of it, the reporter waxed enthusiastic over the tunnel between Cowlairs and Glasgow, in respect not only of its magnificent proportions and splendid workmanship, but also of the fact that it was lighted throughout by gas. It was stated that 43 lamps were used for the purpose; and that the interior being whitewashed, there was abundance of light in the carriages. Another tunnel at Falkirk was similarly whitewashed and lighted. Where is the whitewash or the gaslight now? I do not know why the lamps disappeared, unless it was on the score of expense. But as for the whitewash, well, the railway industry was only in its infancy; and it would appear as if the grimy aspect which the interior of a railway tunnel was bound to assume, had not then dawned upon the minds of railway projectors. There is a very singular recommendation, in an Edinburgh newspaper published on Sept. 29, 1841, by a writer over the signature of "Y.," that the whole of the leading roads from the city of Edinburgh should be lighted for many miles. Taking the road to Haddington as an example, he suggested that it might be lighted for a distance of 20 miles. Six miles of this road were already furnished with main pipes. It would be necessary to erect a gasholder at Tranent; but as it could be used for domestic supply in the village, he did not include the cost of it in his estimate. He considered that a 4-inch pipe to Tranent, and a 2-inch pipe beyond, would be sufficient. The new main he calculated could be laid for £249 per mile, or £3490 in all; and the lamp-posts, at £75 per mile, would cost £1275. The cost of lighting, extinguishing, cleaning, and repairing the lamps, at £33 per mile, would amount to £661. Then the ingenious writer proceeded: "We are not sanguine enough to expect that this great improvement can be effected within a short period of time; but neither have we any doubt that, within not a great many years, gas lights will be placed along the whole line of road from Edinburgh to Dunbar, on a great part of the road from Edinburgh to Glasgow, and on the south road as far as Blackshiels, as well as on all the considerable thoroughfares leading from the city." These expectations have not been realized; but they were not so ridiculous as may at first sight appear. At the time the letter was written, meetings were being held to consider the advisability of having "a railroad" between London and Edinburgh; and, necessarily, all the traffic was being conducted on these leading thoroughfares. The advent of the railway threw the roads into the shade; otherwise there is no doubt many of them would have been lighted by gas, as suggested by the writer. So that gas companies of those days might have had a grudge against the introduction of railways, which I suppose they had not, because, if they lost prospective revenue on the head of road lighting, they would gain far more in other directions from them.

In Perth, the quantity of gas made since May 1 last has amounted to 117,244,600 cubic feet—an increase upon the quantity in the corresponding period of last year of 8,722,600 cubic feet. The Gas Commissioners, at their monthly meeting on Monday, resolved that all accounts relating to the business of the Commission should be examined by a Committee before being passed. The Works Committee recommended the acceptance of an offer by West's Gas Improvement Company, Limited, to fit up the new retort-house at Friarton with West's regenerator settings and West's manual charging and drawing machinery, including delivery, erection, and all labour complete, and starting to the entire satisfaction of the Commissioners, subject to the condition that the Bill at present before Parliament is passed into law. This was agreed to. The offer of J. Milne and Son, Limited, to supply gauges for the new governor-house, was accepted. It was agreed, on the recommendation of the Works

Committee, to borrow £2000 for the purchase of new meters. Bailie Wright, who moved the recommendation, said they had spent £2100 on meters; and as that would be a heavy drain on the year's finance, it had been thought advisable to borrow the amount named. He did not think they would actually need it all; and it would be repaid in five years.

At a meeting of the Paisley Town Council on Tuesday, the Manager (Mr. G. R. Hislop) reported that, in connection with the extension of the works which is in progress, it will be necessary to expend £599 during the summer for the supply of new properties, or to remove causes of complaint from defective plant. The proposal was sanctioned.

The Stirling Town Council on Monday approved, by a majority, of the undertaking of the Stirling Gaslight Company being acquired in terms of the award of Sheriff Lees, and agreed to the minute of agreement being incorporated in the Bill now before Parliament. It was reported that Professor Kennedy considered impracticable the proposal to utilize a proposed water supply to generate electricity for lighting purposes.

Corporation stocks are the order of the day. This week, the Corporation of Glasgow are inviting tenders for an issue of £500,000 stock at 2½ per cent., redeemable at par in 1910-28. The securities offered are the rates leviable for gas, water, electric lighting, markets, and the like, in addition to power to levy a guarantee rate unlimited in amount. The borrowing powers vested in the Corporation amount, after deducting the sums set apart as sinking funds, to £8,287,195. These powers have only been exercised to the extent of £6,993,680. The proposed issue of stock is intended to replace loans which fall due at the term of Whitsunday next, and to provide for new water-works, gas and electric lighting works, sewage purification works, the new tidal weir, and other purposes. The Corporation of Dunfermline are inviting tenders for an issue of £133,500 stock at 3 per cent., redeemable at par in 1917-47. The mimimum price is 102 per cent. The proposed issue of stock is to be applied in paying: (1) The cost of the gas undertaking, purchased by the Corporation from the Dunfermline Gaslight Company (Limited), under the authority of the Burghs Gas Supply (Scotland) Act, 1876, £100,000; (2) Mortgages and temporary loans chargeable under the Dunfermline Water Act, 1876, the Public Health (Scotland) Acts, 1867 and 1871, and the Burgh Police (Scotland) Act, 1892, amounting to £25,900; (3) The cost of new works authorized under the said Public Health and Burgh Police Acts, £6100; and (4) Expenses contingent on creation of stock and compensation in respect of premature redemption of current mortgages, £1500. The Corporation of Edinburgh are also inviting tenders for an issue of £750,000 stock at 2½ per cent., to be used for tramway and general improvement purposes.

The Corporation of Glasgow have acquired from the Caledonian Railway Company, for £10,000, the exclusive right, in perpetuity, to the tunnel which they constructed several years ago under the Forth and Clyde Canal, to connect their Dawsholm and Temple gas-works. There is now free railway communication to both works, from the two leading Railway Companies in the district; and, in addition, the canal passes between the two works. Few works are so well situated for the carriage of materials into and out of them. At the time of the railway strike, the canal was of great service. A Sub-Committee of the Gas and Electric Lighting Committee have accepted the offer of the Airdrie Iron Company to erect the iron and steel work for a new purifier-house at the Tradeston gas-works, for £4787. They have also let the excavation, brick, and mason work of the same building to John Paterson and Sons, Limited, of Glasgow, for £1136.

It is announced from Dundee that there has been a great increase in the output of gas during the current financial year. Last year the increase was 70 million cubic feet; and for this year an increase of 10 million upon that was estimated. The actual increase to the end of last month was 25 million cubic feet. While this is very gratifying, I am beginning, when chronicling these great increases during the current year, to be afraid for the year to come. Should it prove a light one, the present high outputs may not be maintained. I say so because of the exceptional cloudiness of the weather during nearly the whole of last winter. The bad weather began on Sept. 1, and it continued down to nearly the end of March. December was an exceptionally dark month. There is in Edinburgh a Royal Botanic Garden, maintained by Government, in which observations of all meteorological conditions are systematically made; and the report of the observers for December shows that in the whole of that month there were only ten hours of sunshine. Such a state of matters must have very largely affected the consumption of gas. It is not likely, nor is it desirable, that so much darkness should be experienced another year; and so gas managers need not be surprised if they experience a check in their output.

At the last meeting of the Gas and Electric Lighting Committee of the Glasgow Town Council, the Treasurer (Mr. James Fleming) reported the collection of gas and electric lighting rents as follows: For the year 1896-7, and up till March 24, £299,126, as compared with £301,485; thus showing a decrease amounting to £2359 for the current year. Against this it must be remembered that this year the gas consumers are getting the benefit of a reduction of 2d. per 1000 cubic feet. The revenue for electric lighting rents over the same period was £19,921, as compared with £16,676; so that this year shows an increase amounting to £3245. The revenue derived from the sale of residual products to the 28th of February was £90,343, as against £92,447 at the same date last year; showing a decrease of £2103 for nine months of 1896-7.

New Joint-Stock Companies.—The British Carbide Manufacturing Company, Limited, has been registered with a capital of £100,000, in £10 shares, to "acquire and turn to account any way-leaves and water rights, and to construct and maintain dams, reservoirs, turbines, aqueducts, &c., for the purposes of gathering, storing, and using water; to acquire, develop, deal with, and turn to account any patents, patent rights, and inventions; to carry on business as electricians, electrical engineers, and producers of electricity for purposes of light, heat, or power; to experiment with, and develop, the use of carbide of calcium; to construct and maintain rail and tram roads, watercourses, hydraulic, water, and gas works, wharves, piers, warehouses, factories, ships, barges, lighters, and other vessels," &c. The New Brotherton Tube Company, Limited, has been formed, with a capital of £65,000, in £1 shares, to adopt and carry into effect an agreement expressed to be made between the Omnium Contract Corporation, Limited, of the one part and the Company of the other part, for the acquisition by purchase or otherwise, as a going concern, of the undertaking of Brotherton's Tube Company, Limited.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 880).

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	9 Apl.	10½	Alliance & Dublin 10 p. c.	23–25*	..	4 4 0
100,000	10	,,	7½	Do. 7 p. c.	17½–18½*	..	4 1 1
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	108–111	..	4 10 11
200,000	10	29 Oct.	5	Belgrano (B. Ayres), Limited	9½–10	..	5 0 0
100,000	Stck.	30 Dec.	5	Do. 5 p. c. Deb. Stk	102–105	..	4 15 3
200,000	5	12 Nov.	6½	Bombay, Limited	6½–7½	..	4 6 8
40,000	5	,,	6½	Do. New, £4 paid	5–6	..	4 6 8
380,000	Stck.	26 Feb.	12	Brentford Consolidated	285–290	..	4 2 9
240,000	,,	,,	9	Do. New	223–228	..	3 18 7
50,000	,,	,,	5	Do. 5 p. c. Pref.	138–143	..	3 9 11
159,375	,,	11 Dec.	4	Do. 4 p. c. Deb. Stock.	130–134	..	2 19 9
220,000	Stck.	26 Mar.	11½	Brighton & Hove Original	273–278	+3	4 2 8
208,820	,,	,,	8½	Do. A Ord. Stk.	197–202	..	4 4 2
933,500	Stck.	26 Feb.	5	Bristol, 5 p.c. max.	130–135	..	3 14 1
420,000	20	26 Mar.	11½	British	56½–57½	..	3 18 3
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	23–25	..	4 12 0
71,000	10	,,	8½	Do. 7 p. c.	18–20	..	4 5 0
500,000	10	15 Oct.	6	Buenos Ayres (New) Limited	9½–10	..	6 0 0
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	101–103	..	5 16 6
150,000	20	26 Feb.	8½	Cagliari, Limited	29–31	..	5 6 5
100,000	10	30 Sept.	6	Cape Town & District, Ltd.	16–17	..	3 10 7
50,000	50	3 Nov.	6	Do. 6 p. c. 1st Mort.	57–59	..	5 1 8
550,000	Stck.	9 Apl.	13½	Commercial Old Stock	340–345*	..	3 18 3
165,000	,,	,,	10½	Do. New do.	252–257*	..	4 1 8
165,000	,,	11 Dec.	4½	Do. 4½ p. c. Deb. do.	150–155	..	2 18 0
800,000	Stck.	30 Dec.	13	Continental Union, Limited.	255–260	..	5 0 0
200,000	,,	,,	10	Do. 7 p. c. Pref.	215–220	..	4 10 11
51,600	Stck.	26 Feb.	14	Croydon Com'cial A 10 p. c..	317–322		4 6 11
163,400	,,	,,	11	Do. B 7 p. c.	255–260	+3	4 4 7
535,000	Stck.	26 Feb.	5½	Crystal Palace Ord. 5 p.c. Stk	140–144	..	3 12 11
60,000	,,	,,	5	Do. 5 p. c. Pref.	140–143	..	3 9 11
486,090	10	29 Jan.	11	European, Limited	24½–25½	..	4 6 3
354,060	10	,,	11	Do. £7 10s. paid	17½–18½	..	4 9 3
5,836,590	Stck.	12 Feb.	12½	Gaslight & Coke, A, Ordinary	300–305	..	4 3 6
100,000	,,	,,	4	Do. B, 4 p. c. max.	110–114	..	3 10 2
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	308–313	..	3 3 10
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	145–150	..	3 6 8
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	210–215	..	3 9 9
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	207–212	..	3 6 0
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	307–312	..	3 4 1
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	182–187	..	3 4 2
1,061,150	,,	11 Dec.	4	Do. 4 p. c. Deb. Stk..	137–142	..	2 16 4
294,850	,,	,,	4½	Do. 4½ p. c. do.	150–155	..	2 18 1
908,000	,,	,,	6	Do. 6 p. c. do.	207–212	..	2 16 7
70,000	10	29 Oct.	6	Hongkong & China, Limited	12–13	..	4 12 4
3,800,000	Stck.	12 Nov.	10†	Imperial Continental	209–214	+3	4 13 5
376,400	100	1 Feb.	4	Do. 4 p. c. Debs. Red.	100–103	..	3 17 8
473,600	Stck.	12 Feb.	3½	Do. 3½ p. c. Deb. Stk	104–107	..	3 5 5
75,000	5	11 Dec.	6	Malta & Mediterranean, Ltd.	5¾–6¼	..	4 16 2
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	111–113	..	4 8 6
250,000	100	,,	4½	Do. 4½ p. c. Debs.	107–109	..	4 2 7
541,920	20	12 Nov.	5	Monte Video, Limited	15–16	..	6 5 0
150,000	5	26 Nov.	8	Oriental, Limited	8½–9	..	4 8 11
135,000	5	,,	8	Do. New, £4 10s. paid	7½–8	..	4 10 0
15,000	5	,,	8	Do. do. 1879, £1 paid	1½–2	..	4 0 0
60,000	5	26 Mar.	7	Ottoman, Limited	5–5½	..	6 7 3
420,000	100	2 Nov.	6	People's Gas } 1st Mtg. Bds.	104–109	..	5 10 1
500,000	100	1 Dec.	6	of Chicago } 2nd Do.	104–109	..	5 10 1
250,000	10	30 Sept.	10	San Paulo, Limited	13½–14½	..	6 18 0
5,475,000	Stck.	26 Feb.	5½	South Metrop., 4 p.c. Ord.	141–144	..	3 12 11
850,000	,,	14 Jan.	5	Do. 5 p. c. Deb. Stk.	173–177	..	2 16 6
60,000	Stck.	12 Mar.	11½	Tottenham & Edmonton, A	275–285	..	4 0 10
60,000	,,	,,	8½	Do. B	190–200	..	4 5 0
182,380	10	30 Dec.	10	Tuscan, Limited.	14–15	..	6 13 4
149,900	10	2 Jan.	5	Do. 5 p. c. Debs. Red.	101–103	..	4 17 1
				WATER COMPANIES.			
746,159	Stck.	30 Dec.	10½	Chelsea, Ordinary	330–335	–3	3 2 8
150,000	,,	,,	5	Do. 5 p. c. Pref.	175–180	..	2 15 6
160,000	,,	,,	4½	Do. 4½ p. c. Pref. Stk., 1875	158–162	..	2 15 6
175,785	,,	26 Mar.	4½	Do. 4½ p. c. Deb. Stock	160–165	..	2 14 6
1,720,560	Stck.	9 Apl.	7	East London, Ordinary	220–225*	..	3 2 2
654,740	,,	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	164–169	..	2 13 4
390,000	,,	,,	3	Do. 3 p. c. Deb. Stk.	106–108	..	2 15 7
700,000	50	11 Dec.	7½	Grand Junction, 10 p.c. max.	112–117	..	3 4 1
295,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	148–153	..	2 12 4
708,000	Stck.	12 Feb.	12	Kent	340–345	..	3 9 7
160,000	,,	,,	7	Do. New, 7 p. c. max.	212–217	..	3 4 6
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	272–277	..	3 8 7
406,200	100	,,	7½	Do. 7½ p. c. max.	222–227	..	3 6 1
350,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	147–150	..	2 13 4
500,000	100	12 Feb.	13	New River, New Shares	420–425	..	3 1 1
1,000,000	Stck.	29 Jan.	4	Do. 4 p. c. Deb. Stk.	152–155	..	2 11 7
902,300	Stck.	30 Dec.	6	S'thwk & V'xhall, Ordinary	155–160	..	3 15 0
126,500	100	,,	6	Do. Do. 7½ p. c. Max.	150–155	..	3 17 5
489,200	Stck.	,,	5	Do. Do. 5 p. c. Pref.	175–180	..	2 15 7
1,019,585	,,	9 Apl.	4	Do. 4 p. c. A Deb. Stk.	145–148*	..	2 14 2
1,155,066	Stck.	11 Dec.	10	West Middlesex	310–315	..	3 3 6
200,000	,,	,,	4½	Do. 4½ p. c. Deb. Stk.	163–168	..	2 13 7

† Next Dividend will be at this rate. *Ex div.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 17.

Sulphate of Ammonia.—The market has been somewhat irregular; and sales have been made at £7 10s. f.o.b. Leith by makers. Quotations at other ports range from £7 12s. 6d. to £7 15s. Makers have been rather firm in their ideas, having a good demand for home consumption. But considerable parcels of second-hand stuff, especially in Scotland, have been forced off at below makers' quotations; and these sales have had the effect of depressing prices generally. The forward position continues to be offered freely by speculators, at a discount on spot prices up to the end of June, and at a moderate premium for July-September.

Nitrate of Soda.—While deliveries have been considerable, they have not, owing to the large visible supply, been sufficient to improve the tone of the market. The quotations for spot remain at 8s. per cwt. for good up to 8s. 3d. per cwt. for refined quality; but for good lines 1½d. per cwt. less would no doubt be accepted.

LONDON, *April* 17.

Tar Products.—Pitch occupies a peculiar position. Neither manufacturers nor consumers have stocks. Yet the price does not improve; and it is difficult to forecast future value. There is much inquiry for toluol; and this hydrocarbon is undoubtedly scarce. Nineties benzol shows no life; while 50's is more readily saleable, on account of the toluol it contains. Carbolic acid is firm, with pressing inquiries for summer delivery. There is a good outlook for solvent naphtha. Creosote is moving off better. Anthracene is quoted weaker; and business in "B" quality at rates given below has taken place during the week. Naphthalene is steadier, with an interesting outlook for forward delivery. Lower prices are being taken for tar all round.

Business has been done during the week at the following rates: Tar, 15s. to 20s. Pitch, 21s. to 23s. Benzol, 90's, 2s. 3d.; 50's, 2s. 3½d. Toluol, 2s. 4½d. Solvent naphtha, 1s. 7½d. Crude, 30 per cent., naphtha, 1s. 1d. Creosote, 1⅛d.; liquid, 1¾d. Heavy oils, 35s. Carbolic acid, 2s. 5d. Naphthalene, 57s. 6d. Creosote salts, 25s. Anthracene, "A," 7d.; "B," 5d. to 6d.

Sulphate of Ammonia is weaker. Shipments, however, are larger than ever; and business in the article is steady, though prices continue to go lower. An important circular has been issued by the large manufacturers, which ought to have a beneficial effect upon market prices. The marvel is that those interested in the sulphate of ammonia market have not taken action before to neutralize the baleful competition that has arisen from the Permanent Nitrate Committee. Sulphate of ammonia is quoted at £7 10s. to £7 12s. 6d, less 3¼ per cent.

The Amersham, Beaconsfield, and District Water Company have resolved to construct a new covered service reservoir, capable of holding 100,000 gallons, at Coleshill, from plans prepared by Mr. E. A. Sandford Fawcett, Assoc.M.Inst.C.E.

COAL TRADE REPORTS.

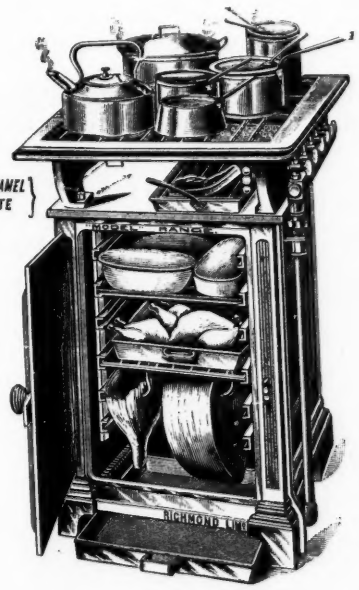
From Our Own Correspondents.

Lancashire Coal Trade.—Nothing further can be reported with regard to forthcoming gas-coal contracts, except that, as intimated last week, it would seem to be doubtful whether colliery proprietors, though they are talking of quoting advances, will be more than able to maintain last season's low prices. Beyond the few inquiries stirring previously referred to, nothing definitely has yet been put through. In the general trade of the district, there has perhaps been a little more business in anticipation of the holidays; and some of the pits have been kept in full time. But mostly four days per week is about the average; and though the leading collieries are holding to their quoted prices, list rates for round coal are scarcely firm in all cases. Best Wigan Arley averages 10s. per ton at the pit; Pemberton four-feet and seconds Arley, 8s.; and common round coal, from 5s. 9d. and 6s. 3d. to 6s. 9d. and 7s. Engine fuel is active; the present business in the chemical trade creating an extra demand on slack. For some of the better qualities, prices are hardening; but the general average is still from 3s. to 3s. 6d. per ton for common slack, to 4s. 6d. and 4s. 9d. for best sorts. The shipping trade is moderate, with ordinary steam coal readily obtainable at 7s. 6d. to 7s. 9d. per ton delivered at the Mersey ports.

Northern Coal Trade.—As usual before holidays, there has been fuller work at most of the collieries; consumers naturally desiring to increase stocks in antic pation, while the desire of shipowners to get their steamships away before the stoppage also increases the demand. Thus the collieries have been very fully employed up to Friday. Best Northumbrian steam coals are firm and higher priced; the quotation varying from 8s. 6d. to 8s. 9d. per ton f.o.b. Second-class steam coals are 7s. 9d. to 8s. per ton; and steam smalls, 3s. 9d. In the gas coal trade, more contracts have been entered into at 6s. 6d. per ton f.o.b.; and the general price ranges from that up to 7s. per ton for single cargoes. There is no change in the manufacturing coal trade. Gas coke is rather weaker in price at some of the inland gas-works.

Scotch Coal Trade.—There is a good demand for the best qualities of ell coal, which sells well abroad; and prices are firm. Splint is rather more plentiful than there is demand for, with the result that the prices have eased a little. Main remains unchanged. The rates quoted are: Main, 6s. 6d. per ton f.o.b. Glasgow; ell, 7s. to 7s. 3d.; splint, 6s. 9d. to 7s. The shipments for the week amounted to 138,417 tons—an increase of 1341 tons as compared with the previous week, and of 23,373 tons as compared with the corresponding week of last year. For the year to date, the total shipments have been 1,818,748 tons—an increase of 88,773 tons over the corresponding period of 1896.

Chelmsford Rural Water Supply.—The Chelmsford Rural District Council purpose borrowing £5540 to carry out a scheme for providing a water supply for the parishes of Little Baddow, Danbury, East Hanningfield, Rettendon, Ranwell, Sandon, and Woodham Ferris.



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Celebrated

"MODEL"

Gas-Cooking Range.

SPLENDID VALUE.
ALL BURNERS REMOVABLE.

Prices, £3 7s. to £40.

Reductions in Price.—The Margate Gas Company are about to lower the price of their gas to 2s. 6d. per 1000 cubic feet; and the Dartford Company have reduced their price from 3s. 3d. to 3s.

Dissatisfaction at the Birmingham Gas-Works.—For some time considerable dissatisfaction has (says a local paper) prevailed among certain sections of the workmen employed at the Birmingham Corporation Gas-Works; and a memorial embodying their grievances has been drawn up. At a meeting of the Committee yesterday week, a deputation representing the workmen waited upon the members, and discussed the points in dispute with them. Although the interview was a protracted one, it is believed that no definite decision was arrived at; but that there is a likelihood of the existing grievances being removed shortly.

The Quality and Price of Gas at Lichfield.—At the meeting of the Lichfield City Council last Wednesday, a report was presented by a Special Joint Committee of the City Council and Tradesmen's Association on the subject of the gas supply. The Committee had asked the Gas Company to increase the illuminating power of the gas from 14 candles to a minimum of 16 candles, to reduce the price from 3s. 4d. to 3s., or less, per 1000 cubic feet, and to provide meters free of rent. The Company, it was stated, declined either to raise the quality or make any concession as to the meters; but they promised that the question of a reduction in price would be taken into consideration.

Rye Water Supply.—Mr. R. H. Bucknill, on behalf of the Local Government Board, recently held an inquiry at Rye, with respect to the application of the Town Council to borrow £500 for extending the water supply by the construction of works at Cadborough. The Town Clerk (Mr. W. Dawes) said there had for many years been a shortness of water in the summer. About £257 had been laid out in boring operations at Cadborough; and a good supply had been obtained at that place. Mr. P. H. Palmer, the Borough Engineer of Hastings, estimated that the quantity obtained by pumping would be from 100,000 to 150,000 gallons a day. The Rye Traders' Association, who opposed the application, put forward a scheme for driving headings at Point Hill, at a cost of £500, and the construction of a reservoir at a cost of about £4000.

The Pollution of the River Dee.—Representatives of the county councils and authorities through whose jurisdiction the Dee passes agreed, at a conference at Chester yesterday week, that it was expedient the County Councils of Cheshire, Denbighshire, Flintshire, Merionethshire, Shropshire, and the county borough of Chester, should jointly concur in petitioning the Local Government Board to issue a Provisional Order, under the Local Government Board Act of 1888, to constitute a Joint Committee for putting in force the Rivers Pollution Act of 1876 for that portion of the watershed of the River Dee above the weir at Chester. A further resolution of the conference recorded its opinion that the Chester Water Company should contribute annually "a substantial sum" towards the expense of carrying out the purposes of the Order constituting the Joint Committee.

The Purchase of the Hunstanton Gas and Water Undertakings.—As already announced, the terms between the Hunstanton Urban District Council and the Hunstanton Gas and Water Companies for the purchase of their undertakings have been completed; and at a meeting last Wednesday details were given showing the progress of negotiations. At first an offer was made of £12,310 for the water, and £3833 for the gas works; but subsequently, on the advice of the Council's Parliamentary Agents, a sum of £14,200 was offered for the water, and £4180 for the gas works, together with £620 in payment of costs incurred by the Companies. Finally, the exact terms of the purchase were arranged as follows: Water-works, £13,000, and a loan of £1200 to be taken over; gas-works, £4050, and a loan of £1100 to be taken over; general purposes, £650—total, £20,000. The Companies are to retain their reserve balances in the bank and in hand, and to take rents to the 29th of September; the purchase to be completed by the 1st of October. If the money is not paid by March 31, 1898, the agreement will become void.

The Prepayment System at West Bromwich.—At the last meeting of the West Bromwich Town Council, the Gas Committee reported that they had received orders for 1000 automatic prepayment meters, and had resolved to provide 500—bringing up to 1500 the number in use.

The New Retort-House Rules at the Leeds Gas-Works.—The men employed at the Leeds Corporation Gas-Works have not taken kindly to the new working rules which the Gas Committee have framed for the attendants of the machine-stoking appliances at the New Wortley works, and which rules are to come into operation next Thursday. At a meeting of the men last Sunday week, they unanimously passed resolutions protesting against the new rules, and agreeing to submit to the Gas Committee a set applicable to both hand and machine stokers.

St. Helens Water Supply.—The Water Committee of the St. Helens Corporation considered last Wednesday the steps that should be taken to ensure an adequate supply of water to the borough. The Water Engineer (Mr. Lackland) recommended that a second pumping-engine should be erected at the Kirkby station, at a cost of £8000; but most of the members favoured an alternative scheme, which provided for the sinking of a well and the erection of a pumping-station at Melling. The cost of the latter project was put at £17,000; and the general opinion appeared to be that money would be saved in the end by incurring the larger expenditure now. It was agreed that the Melling scheme should be adopted; and the Engineer was instructed to prepare the necessary plans and estimates.

The Draycott Gas Company have placed an order with Messrs. R. Dempster and Sons, Limited, of Elland, for a steel tank and telescopic gasholder, to contain 100,000 cubic feet; also for a rotary exhauster.

Messrs. W. Parkinson and Co. held a very successful gas exhibition from Monday to Thursday last week, in the Public Hall, Smethwick. It was opened by Mr. G. Bowden; and Miss Edith Sanderson gave practical demonstrations on cookery twice daily.

The tender of Mr. T. D. Ridley, of Cardiff and Middlesbrough, for the extension of the filter-beds of the Cardiff Water-Works for £10,114 17s. 6d. has been accepted. The estimate of the Engineer (Mr. C. H. Priestley, Assoc. M. Inst. C.E.) was for £10,548 5s. 4d.

Messrs. Ashmore, Benson, Pease, and Co., Limited, have just received orders for columnless gasholders on their patent steel cable system for Bucharest (Roumania), Svendborg (Denmark), and Barking. They have now in hand a dozen holders on this principle.

An exhibition of gas appliances was opened at Dewsbury, on Monday night last week, by Alderman G. A. Fox, the Chairman of the Corporation Lighting Committee. Among the manufacturers represented were Messrs. Fletcher, Russell, and Co., and Messrs. C. Wilson and Son.

Messrs. Fletcher, Russell, and Co., Limited, and Messrs. John Wright and Co., Limited, furnished the gas-stoves at a successful exhibition held by the Newmarket Gas Company in the week ending the 10th inst., during which cookery lectures were given by Miss Margaret Wright, with demonstrations on the stoves of each maker alternately.

Messrs. W. C. Holmes and Co., of Huddersfield, have secured the contract for the supply of the plant required by the newly-formed Killamarsh Gas Company; and the tender of Mr. G. Wright, of Worksop, has been accepted for the buildings. Messrs. Holmes and Co. have also obtained the contract for the supply of a testing-plant for the Southport Corporation Gas-Works, at a cost of £789.

The annual meeting of shareholders in James Milne and Son, Limited, was held last Tuesday. The report presented indicated that, after paying interest on the debentures and allowing for depreciation on the machinery and plant, as well as carrying a further £1250 to the reserve fund, the balance of net profit enabled the Directors to recommend the payment of 6 per cent. on the preference and ordinary shares, and 20 per cent. on the deferred shares—a considerable sum being carried forward.

GWYNNE & BEALE'S
PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM, LONDON." Telephone No. 65,095.

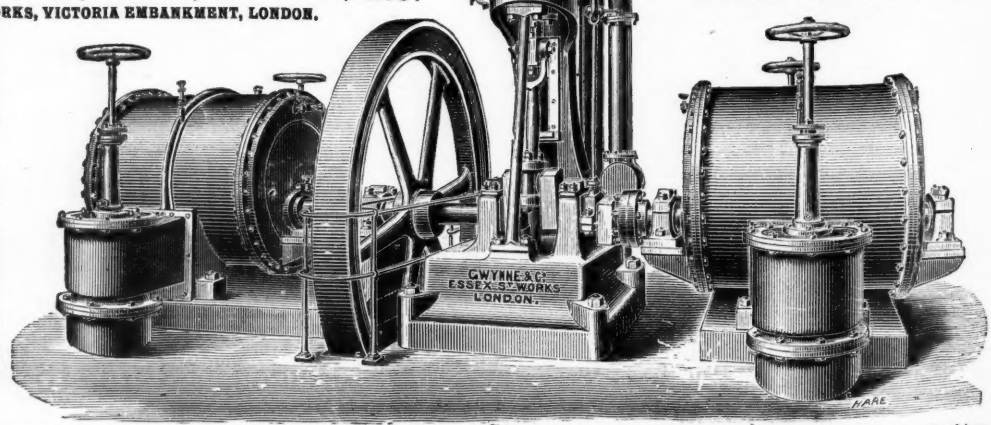
GWYNNE & CO.,
HYDRAULIC AND GAS ENGINEERS,
BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

Late ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON.

They have completed Exhausters to the extent of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Their Exhausters can be made, when desired, on their New Patent Principle to pass Gas without the slightest oscillation or variation in pressure.

MANY SIZES OF EXHAUSTERS KEPT IN STOCK.



Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, PATENT RETORT-LIDS, STEAM-PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

Exhausting Machinery at Fulham and Bromley Gas-Works, London—each set passing 400,000 cub. ft. per hour drawing 14 miles distant from Beckton.

Catalogues and Testimonials sent on application.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS, should be received not later than the FIRST POST on SATURDAY.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

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O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
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ANDREW STEPHENSON, AGENT. All communications re Oxide to be addressed to Palmerston Buildings.

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BROTHERTON AND Co., Ammonia Distillers.
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TUBES for Gas, Steam, and Water (all Sizes), Welded or Riveted. TANKS, HYDRAULIC MAINS, RETORT-LIDS, &c.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See p. 859, last week's issue.)
Telegrams: "HUTCHINSON BROS., BARNSLEY."

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PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

RE-ENGAGEMENT wanted by young Man (age 26) in any position of trust in a Gas-Works. Ten years' Experience. Full Honours Certificate in Gas Manufacture. Good References. Abstainer. No objection to go abroad.
Address No. 2830, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Engineer of a large Gas-Works, with exceptional advantages, has a vacancy for a PUPIL.
Apply, by letter, to No. 2833, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Gorleston and Southtown Gas Company have a vacancy for an ARTICLED PUPIL to learn Gas Engineering.
Apply to W. PALGRAVE BROWN, Southtown, GREAT YARMOUTH.

WANTED, a Draughtsman thoroughly well up in Retort-Settings of all descriptions and general Gas-Works Plant. One who has had practical experience in the erection and working of Retort-Settings preferred.
Apply, stating Age, Experience, and Salary required, to No. 2836, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SECRETARY WANTED FOR GAS-WORKS.

WANTED, a practical and experienced Man in Gas Manufacturing, by a small Limited Company in a rising District, with a rapidly increasing Population. Must be able to conduct all the usual work of a Secretary, and have sufficient practical knowledge of Gas Making to efficiently inspect the Works, including Meters and all the necessary Apparatus, and be sufficiently informed to superintend the Property and operations of the Company.
Reply, by letter *only*, to 309 *Daily Post*, Birmingham, stating Age, past Experience, and Wages required. Unexceptional Reference necessary. A good Salary will be given to a thoroughly qualified and responsible man.

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

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JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."
[For Illustrated Advertisement, see April 6, p. 804.]

SADLER & Co., Ld., Middlesbrough; ULVERSTON (BARROW); PORTSMOUTH; CARLTON (N.E.R.); and STOCKTON. Tar and Petroleum Distillers. Benzol and Petroleum Spirit, 700 and other Gravities specially prepared for Carburetting. SOLAR OIL for Gas Making, Kerosene, &c.
Correspondence invited.
Telegraphic Address: "Sadler, Middlesbrough."

ALEX. P. KER, C.E., Consulting Gas Engineer, Hunton Road, Gravely Hill, Birmingham, 25 Years Assistant Engineer and Manager of Works to the Corporation of Birmingham and their predecessors, MAY BE CONSULTED on all matters connected with GAS ENGINEERING, including Valuations, Alterations, Additions and Extensions, &c. REPORTS upon EXISTING WORKS and IN PROGRESS. EXAMINATIONS OF GAS for ILLUMINATING POWER and IMPURITIES conducted. Plans, Specifications, and Estimates prepared.

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WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
Please write for Estimate before ordering elsewhere.

THE Directors of the Galway Gaslight Company, Limited, will, at their Meeting to be held on Wednesday, the 21st day of April, 1897, appoint a suitable person as MANAGER of their Works.
Salary £100 per annum, with Residence on the Premises, Fuel, and Light.
Applications, accompanied by Testimonials as to character and efficiency, addressed to the presiding Chairman, will be received up to One o'clock on the day of Meeting.

By order,
J. B. HUDSON,
Secretary.

Gas Offices, Queen Street,
Galway, March 31, 1897.

SUB-INSPECTOR.

WANTED, at the Reading Gas-Works, a steady and energetic young Man, of good address, as SUB-INSPECTOR of PUBLIC and PRIVATE LIGHTING, &c. He must be a Practical Gas-Fitter, and thoroughly acquainted with Gas Cooking Stoves, Fires, Incandescent, and other Burners, and be able to advise Consumers as to their Gas Supply generally.
Apply, in own handwriting, stating Experience, present Employment, Wages required, Age, &c., to the undersigned.

EDWARD BAKER,
Engineer and Manager.

Reading Gas-Works,
April 2, 1897.

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(GAS DEPARTMENT.)

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WANTED, an industrious and reliable person as METER INSPECTOR. Preference will be given to one who fully understands, and is competent to repair, Dry Meters.
Applications must be sent in not later than April 26, 1897, stating Wages and Experience, with *copies* of two Testimonials, addressed to

JOHN MARSLAND,
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BALE & CO.'S Oxide of uniform quality. SPECIAL FIRE CEMENT, OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
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BLUE PRINTS of all kinds in any weather. Drawings and Tracings promptly executed.
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INCREASE the Efficiency of your PURIFIERS by adopting CRIPPS'S PATENT BYE-PASS VALVE in the lower Tiers of Sieves. Practical Experience proves their Economy. Engineers are repeating orders after thorough trial.
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GAS CARBON Wanted.
Apply to the BRIMINGTON CARBON COMPANY, Sowerby Bridge, YORKS.

GAS TAR and Ammoniacal Liquor Wanted.
Apply to JOSIAH HARDMAN, Milton, STAFFS.

WANTED, to purchase Gas Carbon delivered at nearest Station to Gas-Works, in quantities of not less than 4 tons.
Address, stating Price per ton and quantity, No. 2772, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE, in good condition—A TRAVELLING HOIST. Suitable for Purifiers up to 24 feet square.
Can be seen on application at the GAS-WORKS, Windsor Street, BIRMINGHAM.

FOR SALE—A 12-Horse Power Crossley GAS-ENGINE. Guaranteed in good working order. New type. Also a 100-Light DRY METER (George Glover). To be sold cheap.
Address Offers and Applications for further Particulars to EDWARD JONES, Gas Engineer, NEW MILLS.

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(GAS DEPARTMENT.)

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FOR SALE—18-in. by 14-in. O, and 15- inch and 18-inch Round, MOUTHPIECES, HYDRAULIC MAINS, ASCENSION-PIPES, FURNACE FITTINGS, EXHAUSTERS, TAR-WASHER, 18-inch CENTRE and FOUR-WAY PURIFIER VALVES, 12-inch HYDRAULIC CENTRE-VALVE, METER (12-inch Connections), ENGINES, PUMPS, &c.
Apply for Particulars to Mr. W. S. Haddock, Engineer.

FREDK. TAYLOR, Secretary.
Gas-Works, Warrington.

FOR SALE—Set of four Purifiers, 12 feet square by 4 feet deep (Cutler's make), with Twelve Valves, Connections, and Lifting Gear. In good condition. Also a 10,000 cubic feet EXHAUSTER, by Donkin.

Apply to F. W. THURLOW, Gas-Works, HIGH WYCOMBE.

FOR SALE—Anderson's combined WASHER and SCRUBBER, with Four-Way Valve and 10-inch Connections, suitable for about 150,000 cubic feet per day.

Apply to

THOS. PRICE,
Engineer and Manager.

Gas-Works, Walton-on-Thames.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also COMPLETE WORKS equal to 7000, 20,000, 60,000 cubic feet per diem. **Inquire and compare Prices and Particulars before ordering elsewhere.**

J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

HAMILTON CORPORATION GAS DEPARTMENT.

FOR SALE, complete—A Gasholder, 50 feet diameter (capacity 31,000 Cubic Feet), and One, 60 feet diameter (capacity 60,000 Cubic Feet).

Further Particulars may be had at the Gas Office, Portland Place.

WM. EWING,
Engineer and Manager.

Gas Office, Hamilton,
April 15, 1897.

BOROUGH OF ROCHDALE.

WOOD GRIDS FOR PURIFIERS.

THE Gas Committee of the above Corporation invite TENDERS for the supply of about 8000 feet super. of WOOD PURIFIER GRIDS.

Particulars may be obtained on application to Mr. T. Banbury Ball, the Manager, at the Gas-Works.

Tenders, endorsed "Grids," must be sent in to me not later than Noon on Wednesday, April 28, 1897.

By order,
JAMES LEACH,
Deputy Town Clerk.

Town Hall, Rochdale,
April 15, 1897.

TENDERS FOR RETORTS.

THE Brentwood Gas and Coke Company invite TENDERS for the supply of 20 OVAL RETORTS (Stourbridge), 21 in. by 15 in., and 9 ft. 3 in. long, to be delivered in Trucks at Brentwood Railway Station (G.E.R.), in one month from receipt of order.

The Directors do not bind themselves to accept any tender.

C. A. FIELDER,
Secretary.

Brentwood, Essex,
April 10, 1897.

TENDERS FOR GAS COAL.

THE Brentwood Gas and Coke Company invite TENDERS for the supply of about 4300 Tons of screened GAS COAL in Trucks at the Brentwood Railway Station (G.E.R.), at per ton, to be delivered in the following quantities the second week of each month: June, 140 Tons; July, 160 Tons; August, 300 Tons; September, 500 Tons; October, 550 Tons; November, 500 Tons; December, 560 Tons; January, 500 Tons; February, 350 Tons; March, 300 Tons; April, 250 Tons; May, 190 Tons.

Tenders, with Analysis of the Coal to be supplied, and Terms for Monthly Payments, to be sent to the undersigned on or before the 30th inst.

The Directors do not bind themselves to accept the lowest or any tender.

C. A. FIELDER,
Secretary.

Brentwood, Essex,
April 10, 1897.

ULVERSTON URBAN DISTRICT COUNCIL.

TENDERS FOR COAL AND CANNEL.

THE Gas and Water Committee invite TENDERS for the supply of best screened GAS COAL and CANNEL for One, Two, or Three Years, commencing the 1st of July next.

Parties tendering must give full Particulars of the Coal and Cannel they propose to supply; and name the Pit from which the same will be raised.

Further Information and Forms of Tender may be obtained on application to the undersigned.

Sealed tenders to be sent in not later than the 29th inst., addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Coal or Cannel."

The Committee do not bind themselves to accept the lowest or any tender.

JNO. SWAN,
Engineer and Manager.

ULVERSTON URBAN DISTRICT COUNCIL.

TO TAR DISTILLERS.

THE Gas and Water Committee invite TENDERS for the purchase of the surplus TAR produced at their Works during the Year commencing the 1st of July next.

Further Particulars and Forms of Tender may be had on application to the undersigned.

Sealed tenders to be sent in not later than the 29th inst., addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Tar."

The Committee do not bind themselves to accept the highest or any tender.

JNO. SWAN,
Engineer and Manager.

THE Directors of the Tynemouth Gas Company are prepared to receive TENDERS for a THIRD LIFT to No. 2 GASHOLDER.

Plans and Specifications may be seen at the Office of the undersigned, to whom tenders should be delivered on or before Tuesday, May 4.

W. HARDIE, jun.

Gas-Works, North Shields,
April 15, 1897.

THE Directors of the St. Annes-on-the-Sea Gaslight and Coke Company, Limited, invite TENDERS for the supply of 2200 Tons per annum of screened or unscreened GAS COAL, to be delivered at St. Annes-on-the-Sea in such quantities as may be required during a period of One or Two Years.

Tenders, specifying the description of Coal, &c., are to be sent in on or before Thursday, the 29th of April, 1897, endorsed "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any tender.

WILLIAM H. NUTTER,
Secretary and Manager.

Gas Offices, St. Annes-on-the-Sea,
April 14, 1897.

SHEFFIELD UNITED GASLIGHT COMPANY.

WATER-TANK.

TO ENGINEERS, IRONFOUNDERS, &c.

THE Directors of this Company invite TENDERS for the supply and erection of a CAST-IRON WATER-TANK, 41 ft. 6 in. by 29 ft. 6 in. by 8 ft. 6 in. deep, together with Ladders, Landings, Girders, &c., at their Neepsend Station.

Drawings may be seen, and Specification with Bill of Quantities obtained, on application to the Engineer, Mr. Fletcher W. Stevenson, on payment of 10s. 6d., which will be returned on receipt of a *bond-fide* tender.

Sealed tenders, endorsed "Tender for Water-Tank," must be delivered (by post) at the Company's Offices, not later than the first post on Saturday, the 1st day of May next.

The Directors do not bind themselves to accept the lowest or any tender.

HANBURY THOMAS,
General Manager and Secretary.

Commercial Street, Sheffield,
April 7, 1897.

RAMSGATE CORPORATION.

(GAS AND WATER DEPARTMENT.)

THE Gas and Water Committee invite TENDERS for the supply of first class NEWCASTLE GAS COAL, in three annual quantities of 19,000, 20,000, and 21,000 Tons, delivered free into Carts on the Quay of Ramsgate Harbour.

The first quantity of 19,000 Tons to be delivered in equal monthly quantities between the 1st of July, 1897, and the 30th of June, 1898; the second and third Years' supplies also in equal monthly quantities between the 1st of July, 1898, and the 30th of June, 1899, and the 1st of July, 1899, and the 30th of June, 1900. A distinct price to be named for each annual quantity.

Tenders to be sent in not later than Saturday, May 1, addressed to the Chairman of the Gas and Water Committee, Hardres Street, Ramsgate, endorsed "Coals."

The Committee do not bind themselves to accept the lowest or any tender.

Full Particulars and Form of Tender on application to

WILLIAM A. VALON,
Engineer.

LURGAN GASLIGHT AND CHEMICAL COMPANY, LIMITED.

COAL WANTED.

THE Directors invite Tenders for the supply of 3000 Tons of the best quality (screened) GAS COAL, delivered into Lighters, *ex*-ship at Belfast, free of all Charges.

Delivery of 2500 Tons will be taken before the 1st of November next; the remainder to be delivered at such times before the 1st of April, 1898, as may be required. Vessels carrying from 200 to 300 Tons can at once deliver into Lighters; and these Lighters be back for a further Cargo within a period to be arranged and agreed upon by the Gas Company. Each Cargo must be accompanied by a Certificate from the Colliery Proprietors furnishing the Coal.

Tenders (in sealed envelope), accompanied by reference to Gas-Works using the Coal offered, should reach me not later than Eleven o'clock in the forenoon of Friday, the 30th of April, 1897.

The Directors do not bind themselves to accept the lowest or any tender.

FRED W. MAGAHAN,
Secretary.

Gas-Works, Lurgan,
April 6, 1897.

NEW MILLS URBAN DISTRICT COUNCIL.

TENDERS FOR GAS COAL, &c.

THE New Mills Urban District Council invite TENDERS for the supply of best GAS COAL and CANNEL for the Year ending June 30, 1898.

Estimated Quantity 1500 Tons (more or less) of Coal, and 300 Tons (more or less) of best Cannel, to be delivered in such quantities as may be required from time to time at the L. & N.W. or Midland Railway Stations, New Mills.

Form of Tender and full Particulars may be had on application to Mr. E. Jones, the Gas Manager.

Tenders, with Analysis and full Particulars of the Coal and Cannel offered, to be sent in not later than the 10th of May, 1897, to me the undersigned, and endorsed "Tender for Gas Coal and Cannel."

TENDERS are also invited for the purchase of the surplus TAR and LIQUOR for One Year ending June 30, 1898.

The Council do not bind themselves to accept the lowest or any tender.

JOSEPH POLLITT,
Clerk.

Town Hall, New Mills,
April 17, 1897.

THE Westerham Gas and Coke Company, Limited, invite TENDERS for the supply and setting of a BED of FIVE BEST STOURBRIDGE FIRE-CLAY RETORTS, with the necessary Bricks, Fire-Clay, &c.

Specifications may be had on application to the undersigned.

Endorsed tenders to be sent in by the 5th of May.

By order,
CHAS HOOKER,
Secretary and Manager.

Westerham, Kent.

KETTERING URBAN DISTRICT COUNCIL.

SEWAGE DISPOSAL.

CONTRACT No. V.—COKE BREEZE.

TENDERS are invited for the supply of COKE BREEZE for the Construction of Artificial Filters for the Purification of Sewage.

Particulars and Forms of Tender may be obtained on application to the undersigned.

Tenders, sealed and endorsed "Coke Breeze," must be delivered at this Office not later than Ten a.m., on Monday, the 3rd of May.

The Council do not bind themselves to accept the lowest or any tender.

THOS. READER SMITH, Assoc.M.Inst.C.E.,
Engineer and Surveyor.

Surveyor's Office, Market Hill,
Kettering.

GEORGETOWN (BRITISH GUIANA) GAS COMPANY, LIMITED.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Shareholders of the above Company will be held at the Offices of the Company, 30, Gracechurch Street, in the City of London, on Tuesday, the 4th day of May next, at Three o'clock in the afternoon precisely, to receive the Directors' Report and the Accounts of the Company for the Half Year ended the 31st day of December last, to declare a Dividend, to elect Directors, and an Auditor in place of those retiring by rotation, and to transact the General Business of the Company.

The TRANSFER BOOKS WILL BE CLOSED from the 21st inst. to the 4th prox., both inclusive.

By order of the Board,
SAMUEL WOOD,
Secretary.

Offices: 30, Gracechurch Street,
London, April 6, 1897.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Powers.

He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.

Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.

Offices: 18, FINSBURY CIRCUS, E.C.

SOUTHEND WATER-WORKS COMPANY.

MR. ALFRED RICHARDS begs to notify that the SALE BY AUCTION of 500 £10 SHARES in the above Undertaking announced to be held on the 3rd of May is POSTPONED TO WEDNESDAY, THE 26th OF MAY.

Particulars, when ready, may be obtained of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By Order of the Directors.

200 SHARES IN THE

WORTHING GASLIGHT AND COKE COMPANY.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Monday, May 3, at Two o'clock, in Lots, 200 £10 fully-paid SHARES in the above Undertaking, ranking for a Standard Dividend of 7 per cent. per annum; the last Dividend on similar Shares in the Company having been at this rate.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By Order of the Directors.

2000 SHARES IN THE

WEST HAM GAS COMPANY.

MR. ALFRED RICHARDS will Sell by AUCTION, at the Mart, E.C., on Monday, May 10, at Two o'clock, in lots, 2000 £10 FULLY-PAID SHARES in the above Undertaking, to be issued under the Provisions of the West Ham Gas Act, 1889; the Dividends on these Shares rising or falling according to the Price charged for Gas. The last Dividend on the Company's £10 Shares was at the rate of 6½ per cent. per annum.

Particulars of the SECRETARY of the Company, at the Offices, STRATFORD; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Executors of the late William Charles Barnes, Esq., and other Executors and Owners.

GAS AND WATER STOCKS AND SHARES AS FOLLOWS:—

Chigwell, Woodford, and Loughton Gas Company—£1200 Stock, 379 £10 Shares, and £50 Debenture.
Commercial Gas Company—£531 Stock.
Harrow and Stanmore Gas Company—58 £10 Shares.
Portsea Island Gaslight Company—12 £50 Shares.
Cromer Gas and Coke Company, Limited—40 "A" Shares.
Godstone District Gas Company—60 Shares.
Horley District Gas Company—80 Shares.
Epping Gas Company, Limited—Two Shares.
Clacton-on-Sea Gas and Water Company—80 Shares.

MR. ALFRED RICHARDS will Sell the above BY AUCTION, at the Mart, E.C., on Monday, May 3, at Two o'clock, in lots.

Particulars of the AUCTIONEER, 18 FINSBURY CIRCUS, E.C.

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ISSUED BY
WALTER KING,
11, BOLT COURT, FLEET STREET, LONDON, E.C.

ALL PARCELS SENT CARRIAGE FREE.

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A LEAFLET ON

SULPHATE OF AMMONIA:

ITS SOURCE—RELATIONSHIP TO SOIL—EFFECT ON PLANTS.

By H. H. COUSINS, M.A.,
South-Eastern Agricultural College, Wye.

This is a Reprint from the "JOURNAL" of three Articles, which are of a character eminently suitable for distribution among Farmers and other users of Artificial Manures.

THE VALUATION OF GAS-WORKS FOR ASSESSMENT. — By THOMAS NEWBIGGING, M.Inst.C.E. Price 3/6 (76 pages, demy 8vo., limp cloth).

THE SCIENCE AND PRACTICE OF LIGHTING as applied to Streets, Open Spaces, and Interiors. — By W. H. Y. WEBBER. Price 3/6 (Demy 8vo. cloth).

THE COMPOSITION AND USE OF GAS LIME IN AGRICULTURE.—By (the late) Dr. A. VOELCKER, Professor of Chemistry to the Royal Agricultural Society of England. A 4-pp. leaflet for distribution among farmers and others. Price 5/- per 100.

GASHOLDERS WITH OR WITHOUT GUIDE-FRAMING.—A Discussion between E. Lloyd Pease and F. Southwell Cripps. To which is added a Synopsis of all the Literature (English and Foreign) on Reducing or Abolishing the Guide-Framing of Gasholders, also the principal Literature on Gasholder Construction generally, compiled to March, 1893; with a List of all the English and Foreign Periodicals connected with the Gas Industry.—By F. SOUTHWELL CRIPPS, Assoc.M.Inst.C.E. In Paper Covers. Price 1/-.

ORDERS FOR OTHER TECHNICAL PUBLICATIONS WILL BE EXECUTED AT PUBLISHERS' PRICES.

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97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

E. ASQUITH & CO.,
Hydraulic Engineers,
17, Mather Street, Ancoats, Manchester,
Fit up Plants for
Pressing Anthracene, Naphthalene, &c.
Competent Men sent out to erect same. Estimates given.

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PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT)
New Design, with two Cutting Rollers, making less Breeze than their old pattern.

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Gas Companies are solicited to try Samples of the
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BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

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JAMES OAKES & Co.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,
Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
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LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

HOLMSIDE GAS COALS.
PRESENT DAILY PRODUCE OVER 4000 TONS.
LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton. . 11,205 Cubic Feet.
Illuminating Power, 16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.
PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.
RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton. . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13½ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash. . . . . 1·34 Per Cent.
Tar. . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

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MR. MARK ARCHER,
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NEWCASTLE-UPON-TYNE.

THE "COOMBE" DRAUGHT SCREEN
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For Illustration and Statement of Advantages to be gained by its use, see "JOURNAL," April 6, p. 802.
ALFRED ARCULUS & CO., Glass Manufacturers,
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HEBBURN MAIN GAS COALS.
Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke. . . . . 68 per cent.
For Prices, f.o.b. Ship or Delivered by Rail, apply to
THE WALLSEND & HEBBURN COAL COMPANY, LTD.
8 Lombard Street, NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

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THORNLEY GAS COALS
WORKED BY THE
WEARDALE IRON & COAL Co., Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by
Messrs. J. & H. S. PATTINSON, *May 28, 1895,*

Yield of Gas per Ton . . 10,500 Cub. Ft.
Illuminating Power . . 16·9 Candles.
Coke (of good quality) . . 67·5 per Cent.
Sulphur . . . . . 0·58 „
Ash . . . . . 2·73 „

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

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LANEMARK CANNEL
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Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

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BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

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For Prices, &c., apply to the

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W. H. PARKINSON, FITTER.

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These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

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BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

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FIRE-BRICKS of the highest Quality, made from Fire-Clay of a most Superior and Refractory Character, suitable for **GLASS-WORKS, GAS-WORKS, and BLAST-FURNACES.**

WHITE GLAZED AND SALT GLAZED BRICKS, BUFF FACING BRICKS, &c.

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THE ONLY SUCCESSFUL ECONOMICAL AND EFFICIENT

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Every Gas Engineer, Gas Manager, and Lighting Authority should adopt it.

Applicable to existing Lamps.

THE LARGEST INSTALLATION OF INCANDESCENT STREET LIGHTING IN ANY BRITISH TOWN IS ON THIS SYSTEM.

SUCCESSFUL RESULTS GUARANTEED IN ALL SITUATIONS.

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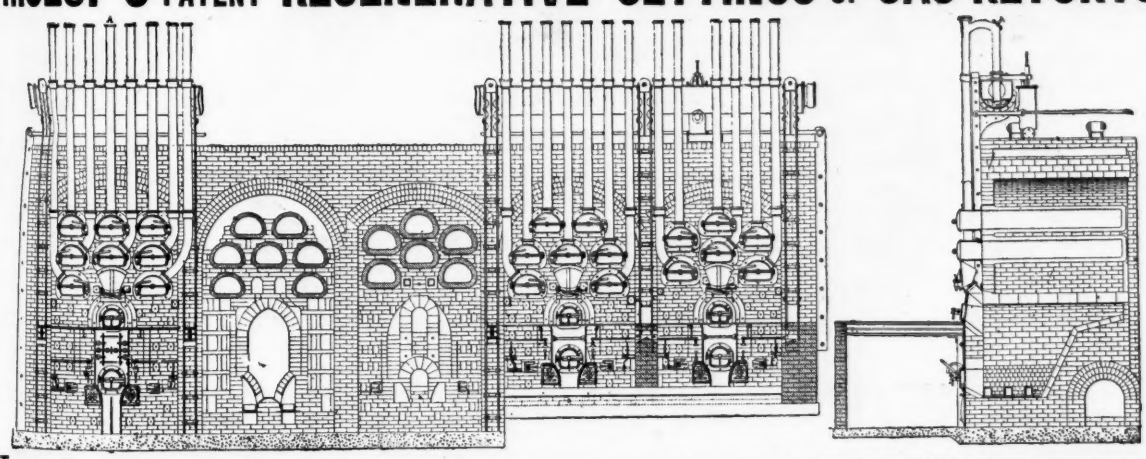
HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE POSITIVELY UNRIVALLED IN PRODUCTIVE CAPACITY, DURABILITY, AND SIMPLICITY OF MANAGEMENT. RETORTS OF ORDINARY DIMENSIONS CARBONIZING FROM 18 TO 24 CWT. OF ENGLISH AND 21 TO 26 CWT. OF SCOTCH COAL PER 24 HOURS, DEPENDING UPON THE NATURE OF THE COAL, AND PRODUCING UP TO FULLY 13,000 CUBIC FEET PER MOUTHPIECE IN THE SAME TIME, AND WITH THE SMALLEST EXPENDITURE OF FUEL ATTAINABLE, AND RETURNING IN PROFIT THE ENTIRE COST OF ERECTION WITHIN TWELVE TO EIGHTEEN MONTHS; AND THUS REDUCING TO INSIGNIFICANCE THE INCREASED COST OF THESE SETTINGS OVER THE COMMON OR GENERATOR FURNACE SYSTEMS.

THESE SETTINGS ARE EXTENSIVELY ADOPTED, AND ARE ERECTED UPON THE SHALLOW AND STAGE FLOOR PLANS. THEY ARE ADAPTED TO ANY EXISTING ARRANGEMENTS, AND PERFECT SATISFACTION GUARANTEED. THE COMPOSITION OF FIRE-RESISTING AND OTHER SPECIAL FIRE-CLAY MATERIALS FURNISHED IS OF THE HIGHEST ORDER; AND THE SYSTEM AS A WHOLE, AS NOW PERFECTED, IS THE RESULT OF LONG EXPERIENCE AND CAREFUL STUDY OF THE PRINCIPLES OF GASEOUS FIRING.

Drawings and Tenders are furnished for the complete erection of Benches, including Retort and Bench Mounting of the most modern and approved description; or existing Ovens fitted up with the Patentee's arrangements.

Full Particulars may be had on application to the Patentee's Agents: **Messrs. JONAS DRAKE AND SON**, Retort Setters and General Carbonizing Engineers, Ovenden, Halifax, Yorkshire, Sole Agents for England, Wales, and Foreign Countries; **C. M. HAMILTON**, Retort Setter and Contractor, 5, Stuart Street, Shawlands, Glasgow, Agent for Scotland and Ireland; and to the Principal Agent, **R. F. HISLOP** (Son of Patentee), General Constructing and Carbonizing Engineer, Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine qua non*

TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED AND AFFORDING THE HIGHEST SATISFACTION.

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[See Illustrated Advertisement, April 6, p. 799.]

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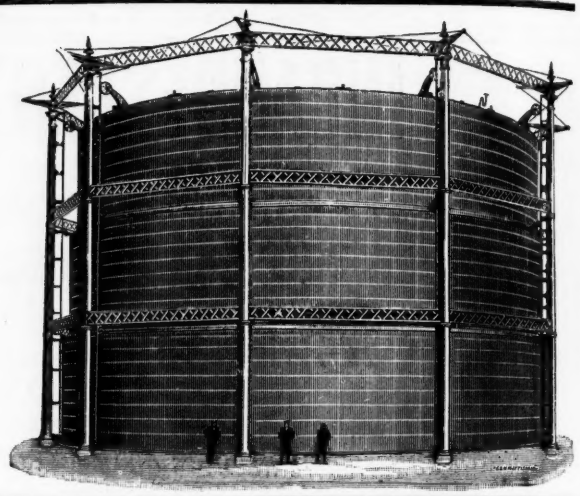

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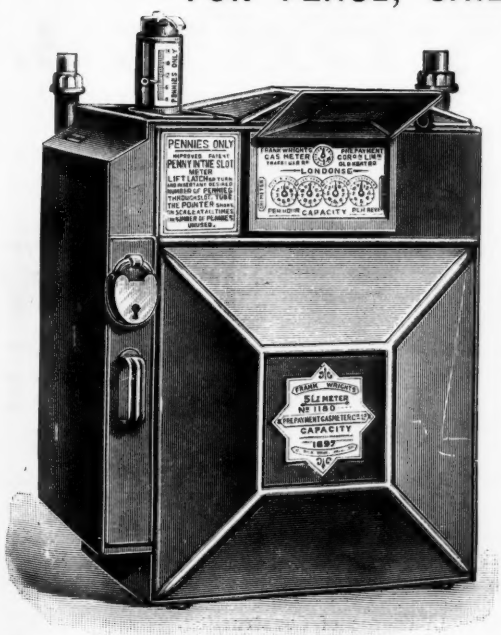

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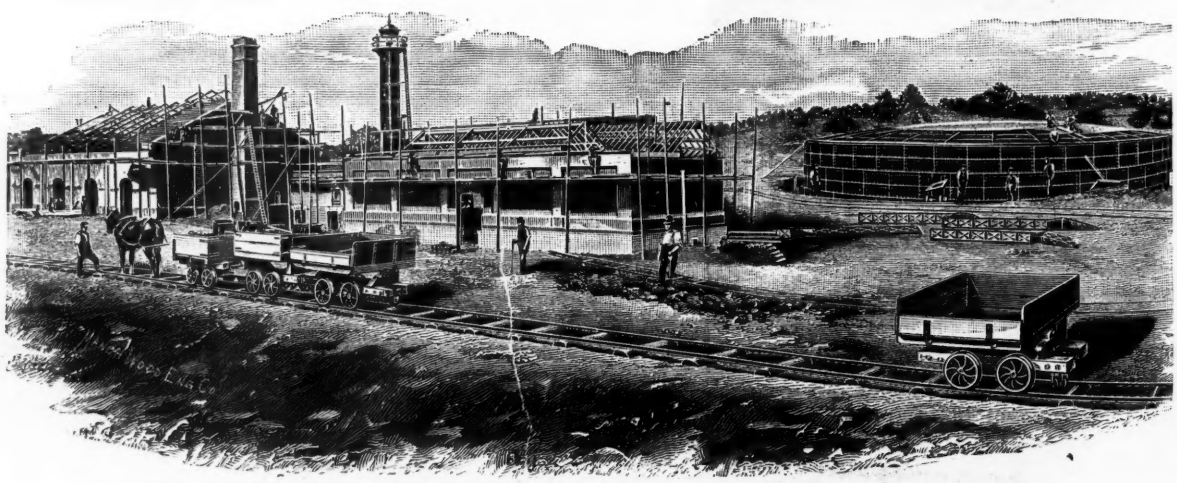

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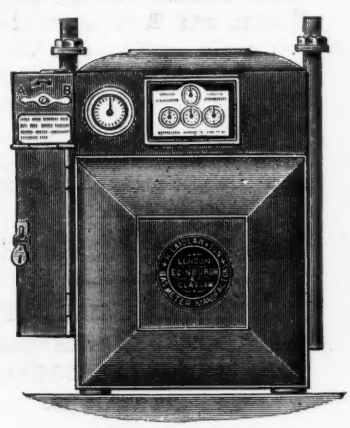

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[See Illustrated Advertisement, April 6, p. 761.]

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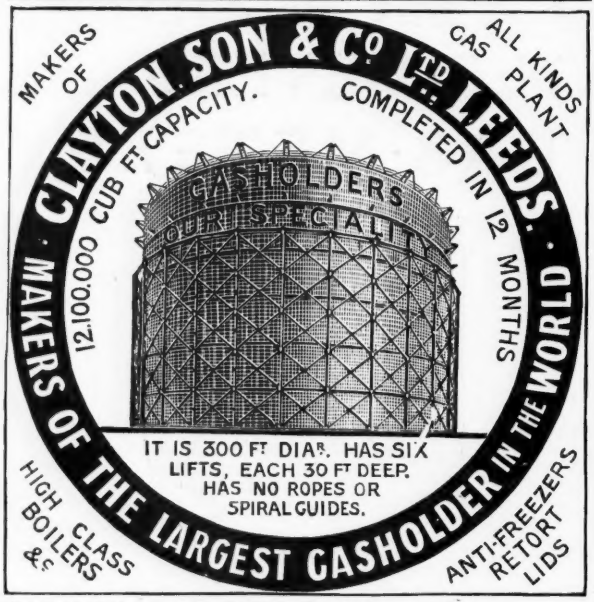
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[See also Advt. p. 876.

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